MAXUS

8440A-8443A

INSTRUMENTATION COMPUTERS/CONTROLLERS

OPERATING AND SERVICE MANUAL

MAXUS ELECTRONIC CORP BOULDER, COLORADO

8440A/8441A INSTRUMENTATION COMPUTERS and 8442A/8443A INSTRUMENTATION CONTROLLERS

OPERATING AND SERVICE MANUAL

VERSION 1.0

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NOTE: *Before installing this device, check the container and the unit for damage. If you find the device has sustained damage, contact the carrier to initiate a claim.*

Check the packing list to make sure all parts and accessories have arrived. If there are any discrepancies, contact MAXUS immediately.

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As supplied by MAXUS ELECTRONIC CORP., this equipment complies with the requirements in Part 15 of the FCC Rules for a Class A computing device. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception, requiring the operator to take all steps necessary to eliminate the interference.

MANUAL PART NUMBER: 85-844001

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8440A/8441A INSTRUMENTATION COMPUTERS and 8442A/8443A INSTRUMENTATION CONTROLLERS

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SECTION 1.0

GENERAL INFORMATION

1.1 INTRODUCTION

The MAXUS 8440A and 8441A Instrumentation Computers and the 8442A and 8443A Instrumentation Controllers are high-performance rack-mountable systems which can be used in a wide variety of control and measurement applications. Their many features include:

- **Intel 386SX or Cyrix/TI 486SLC microprocessor operating at 25MHz**
- **Socket for Intel 80387SX or C & T Super-Math 387SX math co-processor**
- **1 MB of Random Access Memory (RAM) is standard - expandable up to 16 MB on board using standard SIMMs**
- **Super-VGA graphics support with resolution up to 1024 x 768 with 512 KB graphics RAM**
- **Hard drive capacity of 120 MB (17ms access time) standard - up to 535 MB available**
- **1.44 MB 3-1/2in. floppy disk drive accessible from the front panel**
- **Two standard RS-232 compatible 9-pin serial ports and a 25-pin Centronics compatible parallel port standard**
- **Dedicated Keyboard and Mouse ports**
- **Two 16-bit expansion slots for standard PC-compatible cards plus a dedicated 16-bit slot for a Maxus GPIB interface card**
- **Compact dimensions - only 8.375in wide x 3.375in high by 17.0in deep**
- **Light weight - less than 10.5 pounds**
- **High efficiency power supply with built-in thermally regulated cooling fan for high reliability**

The 8440A-8443A may be used as general purpose PCs, but their many unique features make them ideally suited in configuring cost-effective systems for data acquisition, process control, ATE, factory automation, and many other system-level applications.

1.2 8440A-8443A FUNCTIONAL DESCRIPTION

The 8440A-8443A family includes the four models listed in the table below. The models differ in the type of front panel implemented and whether they are labeled as a computer or as a controller. The computer and controller models are identical internally. The 8440A and 8442A models have a 2-line LCD display and data entry keys on the front panel, while the 8441A and 8443A have only the basic front panel controls found on other PCs.

	Front Panel	
	Basic	Full
Computer	8441A	8440A
Controller	8443A	8442A

The 8440A and 8442A may be operated without a PC style keyboard and monitor, a useful feature for situations where the application is dedicated to a

specific function and particularly when the computer is mounted in a rack.

The front panels of the 8440A/8442A and 8441A/8443A models are shown in figures 1.1 and 1.2 respectively. The rear panel is the same for all types and is shown in figure 1.3. General Dimensions for all members of the family are shown in figure 1.4.

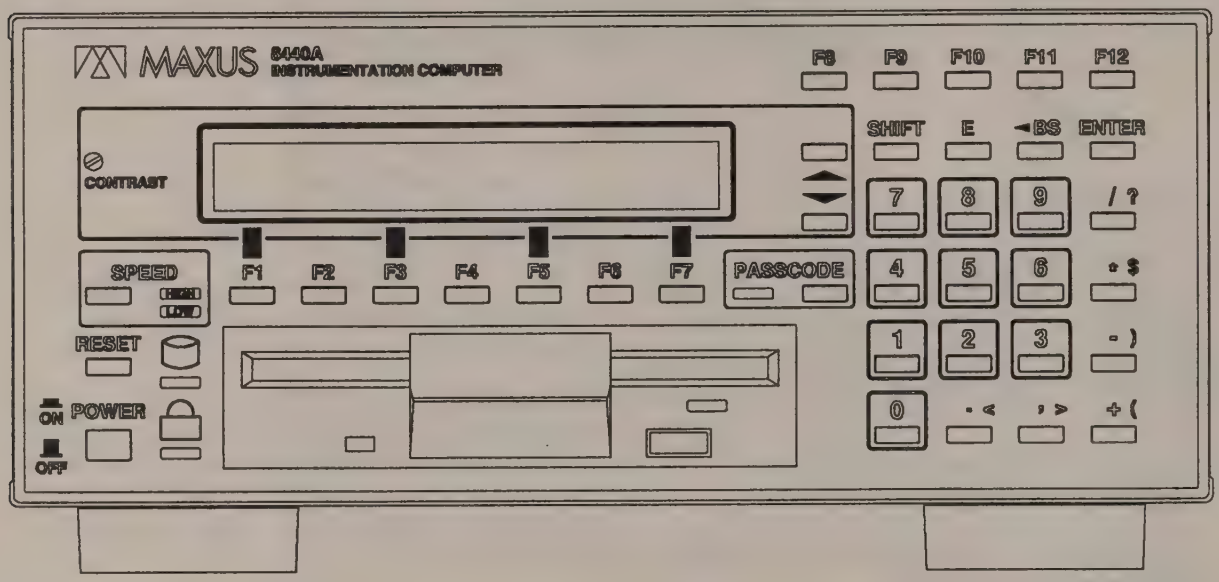


Figure 1.1 - The 8440A Instrumentation Computer and 8442 Instrumentation Controller

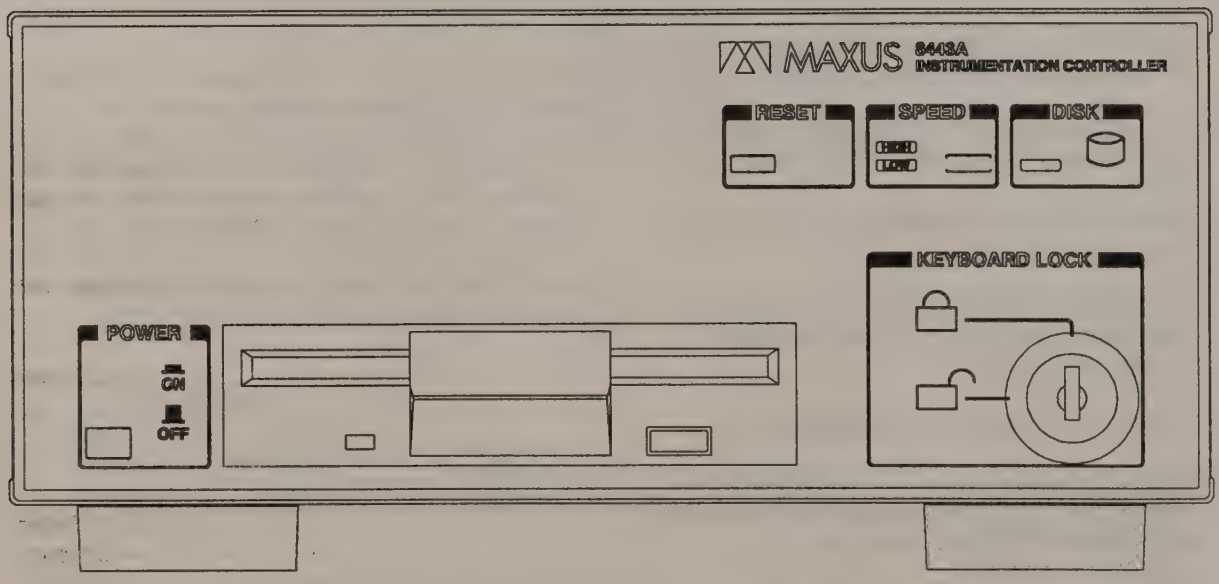


Figure 1.2 - The 8441A Instrumentation Computer and 8443A Instrumentation Controller

8440A-8443A CABINETS

The 8440A-8443A are housed in instrument quality cabinets fabricated from a combination of aircraft aluminum alloy and high-strength flame- retardant polycarbonate. The cabinets provide adequate shielding to meet FCC specifications part 15 requirements. The cabinet also provides cooling to dissipate the generated heat.

Cabinet dimensions are such that allow the computer to be mounted side by side with many of MAXUS' other products and will fit into a standard 19" rack 2U (3 1/2") height when equipped with optional rack-mounting kits. A kit is also available to rackmount a single unit. Both cabinets and mounting kits are physically compatible with Hewlett-Packard System II and System II+ cabinets (used on most of their current products).

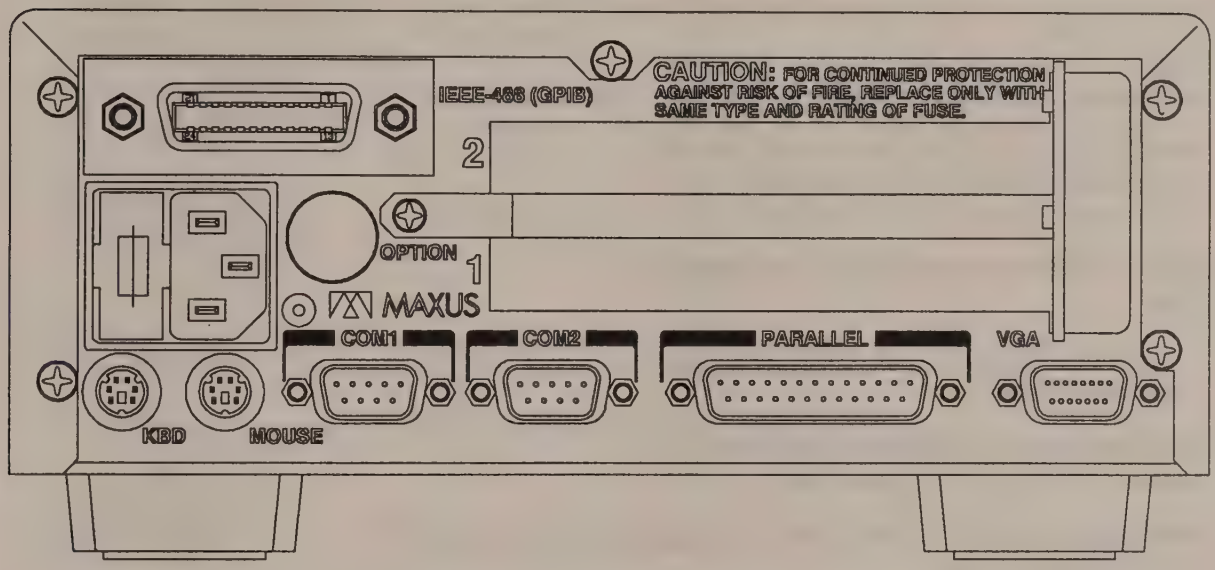


Figure 1.3 - Rear Panel Features of the 8440A-8443A Instrumentation Computers and Controllers

1.3 OPTIONS and ACCESSORIES

INTERNAL OPTIONS

82335X - GPIB Interface Card (mounts in dedicated slot, compatible with Hewlett-Packard 82335 module, includes H-P software)

Option M4 - Upgrade RAM to 4MB (ordered with computer)

Option M4U - Upgrade RAM to 4MB (user upgrade, replaces existing components)

Option M8 - Upgrade RAM to 4MB (ordered with computer)

Option M8U - Upgrade RAM to 4MB (user upgrade, replaces existing components. A second M8U may be used to upgrade from 8 MB to 16 MB)

Option M16 - Upgrade RAM to 4MB (ordered with computer)

Option M16U - Upgrade RAM to 4MB (user upgrade, replaces existing components)

Option C387SX - 80387SX Math Coprocessor

Option CS387SX - Chips and Technology Super-Math 80387SX math coprocessor (high throughput)

Option D213 - 213 MB fixed disk drive (ordered with computer)

Option D213U - 213 MB fixed disk drive (user upgrade, replaces existing components)

Option D535 - 535 MB fixed disk drive (ordered with computer)

Option D535U - 535 MB fixed disk drive (user upgrade, replaces existing components)

COMPANION PRODUCTS

8406A - 7.5in High-resolution Trinitron VGA display monitor (up to 1024 x 768 resolution)

8420A - Keyboard (compact format with 101 keys, numeric keypad, cursor control keys, tactile feel)

RACK MOUNTING, STACKING, and HANDLE KITS

Note: The following kits are illustrated in the installation section.

81-000351 - Single Unit Rack Mount Kit (unit can be mounted to the left or to the right in rack)

81-000358 - Single Unit Rack Mount Kit (unit mounted centered in rack)

81-000352 - Dual Unit Rack Mount Kit (for side by side mounting of two units the same length)

81-000353 - Dual Unit Rack Mount Kit (for side by side mounting of two units differing in length by 3")

81-000354 - Dual Unit Rack Mount Kit (for side by side mounting of two units differing in length by 6")

81-000355 - Dual Unit Rack Mount Kit (for side by side mounting of two units differing in length by 7.5")

81-900002 - Stacking Kit (for mounting two units to each other vertically)

81-900400 - Carry Handle Kit

MANUALS

85–844001 - Additional copies of this Manual, "8440A-8443A Operating and Service Manual".

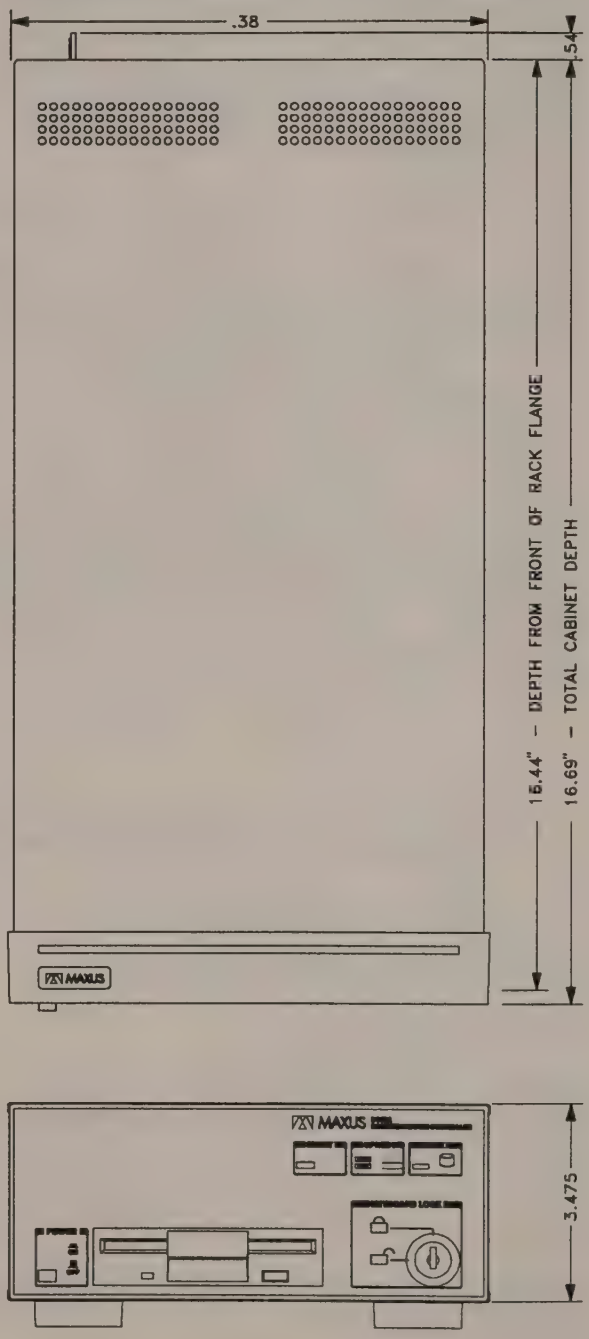


Figure 1.4 - Outline Dimensions of the 8440A-8443A Instrumentation Computers and Controllers

1.3 8440A-8443A SPECIFICATIONS

Characteristics	Specification
Controls and Indicators	
Front Panel Controls (8440A and 8442A)	Power on/off switch, Reset switch, CPU speed select switch, F1-F12 function keys, numeric data entry keys, Passcode entry key, Enter and Backspace keys
Front Panel Controls (8441A and 8443A)	Power on/off switch, Reset switch, CPU speed select switch and Keyboard lock keyswitch
Front Panel Indicators (8440A and 8442A)	LED indicators for "DC-OK", CPU speed select, disk drive activity, and Passcode, Two line by 24-character LCD message display with LED backlight.
Front Panel Indicators 8441A and 8443A)	LED indicators for "DC-OK", CPU speed select, and disk drive activity
CPUs	
Type, standard version	Intel 386SX-25 at 25Mhz clock
Type, option X	Cyrix/TI 486SLC at 25 MHz clock
Math Coprocessors	
Option C387SX	80387SX math coprocessor
Option CS387SX	Chips & Technology Super-math 387SX math coprocessor
Main Memory (RAM)	
Type	SIMM DRAMs, 256 x 9, 1M x 9, or 4M x 9
Standard	1 Mbyte
Option M4, M4U	4 Mbyte
Option M8,M8U	8 Mbyte
Option M16, M16U	16 Mbyte
Diskette Drive	
Type	3.5" removable diskette media
Capacity	1.44 Mbyte
Interface	Standard PC-AT compatible

Characteristics	Specification
Fixed Disk System	
Type	3.5" fixed media
Capacity (standard unit)	120 Mbyte
Capacity (option D213)	213 Mbyte
Capacity (option D535)	535 Mbyte
Interface	IDE standard
Display Interface	
Type	Super-VGA
Display Memory	512 K Bytes
Resolutions	640h x 400v x 256 colors, 640h x 480v x 256 colors, 800h x 600v x 256 colors, 1024h x 768v x 16 colors
Connectors	VGA (rear panel) 15-pin male high density 'D' Features (internal) 26-pin (2 x 13) male .1" ctr. header
Serial Ports	
Number	2
Type	RS-232 and PC-AT compatible
Connector	9-pin male 'D' for each port
Signals Implemented	Output: TXD, DTR, & RTS, Inputs: RXD, DSR, CTS, RLSD, RI
Parallel Port	
Type	Centronics and PC-AT compatible
Connector	25-pin female 'D'
Keyboard Port	
Type	IBM PC-AT and PS/2 compatible
Connector	6-pin miniature DIN round

Characteristics	Specification
Mouse Port	
Type	IBM PC-AT and PS/2 compatible
Connector	6-pin miniature DIN round
Option Card Slots	
Standard Slots	
Number	2
Type	Full 16-bit PC-AT compatible bus
Size	Up to 8.5" maximum length measured from end of card to outside of mounting bracket, not including tab of bracket.
Special slot	
Type	Full 16-bit PC-AT compatible bus
Size	Designed for special option cards available from Maxus
BIOS	
Type	Quadtel with custom features
Physical Characteristics	
Dimensions (see Figure 2.4)	8.375" wide x 3.475" high x 17.0" deep (21.3 cm x 8.9 cm x 43.2 cm)
Weight	9.45 lb. (4.3 kg.)
Construction	Wrap-around aluminum alloy cabinet with flame retardant polycarbonate front bezel. Four removable plastic feet secured to base; tilt-up stands built into front feet. Mechanically compatible with Hewlett-Packard System II and System II+ modular cabinets.
Power Requirements	
Voltage	105-130 or 210-260 VAC (switch-selectable)
Frequency	47 to 440 Hz.
Power	70 watts max.

SECTION 2.0

INSTALLATION

2.1 INTRODUCTION

This section describes the following installation procedures:

- Unpacking and Inspection
- Setting the Line Voltage Switch
- Setting Jumpers and Switches
- Option Installation
- Stacking and Rack Mounting

2.2 UNPACKING AND INSPECTION

The first step of installing the 8440A-8443A is to insure that the computer, accessories, and any options that you ordered have arrived safely and are operative.

The 8440A-8443A shipment should include the following:

The computer or controller itself

A power cord

Microsoft MS-DOS 5.0 Software package

This manual

If you have ordered any options (listed in Section 1.3), find the enclosed packing slip and make sure that you have received all of the items listed on the packing slip. If you are missing any items, please contact the factory immediately so the mistake can be corrected.

Inspect all items for damage. If any damage has occurred during shipment, contact the carrier to make a damage claim, then notify the factory.

2.3 SETTING THE POWER LINE VOLTAGE SWITCH

The standard factory setting for the line voltage switch is 105 to 130 VAC for North American shipments. To set the power supply to its alternate line voltage position, 210 to 260 VAC, proceed as follows:

1. Remove power and interface cables, if attached.

> **WARNING:** Leaving the unit plugged in during dis-assembly could result in severe personal injury and/or damage to the unit.

2. The voltage switch is accessible through an opening on the left side of the unit. Using a small flat-blade screwdriver, carefully move the switch to the desired line voltage range. Visually inspect the switch to be sure that it has moved completely to the desired position, as indicated by the legend showing on the switch actuator.

3. Use a small flat-blade screwdriver to pull open the fuse drawer in the power module on the rear of the unit.

4. Eject the fuse by pushing it with the small screwdriver inserted into the access port in the back of the fuse drawer.

5. Install a fuse of the same type and of the proper value for the selected line voltage. This value is listed on the serial number plate on the bottom of the system.

6. Close the fuse drawer and re-install the power cord.

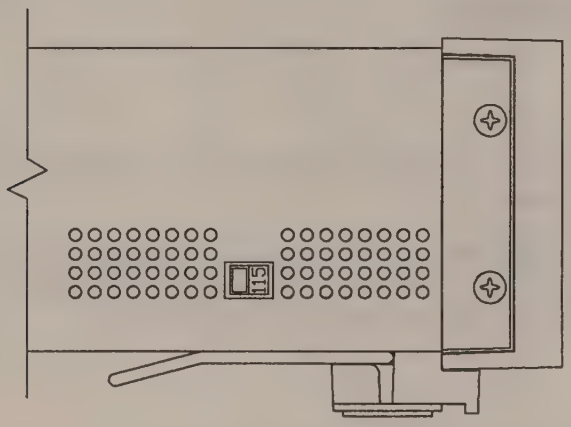


Figure 2.1 - Line Voltage Switch Location on Left Side

2.4 SETTING THE BACKPLANE SWITCHES AND JUMPERS

Changing of the backplane switches and jumpers is only required if the factory default settings are not desired.

To gain access to the backplane switches and jumpers, the cover of the computer must be removed. This is accomplished by removing the five cover screws on the rear panel as shown in figure 2.3, and lifting the cover up at the rear and off.

Figure 2.3 illustrates the locations of the switches and jumper on the backplane circuit board viewed from the right side of the computer chassis. The jumper, J4, determines the CPU speed at startup. The default selection is with the jumper to the right (pins 2-3) for the high speed. Setting the jumper in the left position (pins 1-2) will cause the processor to start up in the slower speed.

Bitswitch 10 can be read by software as described in the reference information section of this manual. It is normally used to enable or disable the password protection mechanism.

The remaining bitswitches set the address of the front panel display and keyboard. Switches 1 through 9 correspond to address bits 9 through 1 respectively. A switch which is on (up) represents a value of zero and a switch which is off (down) represents a value of one. See the reference information section of this manual for further details.

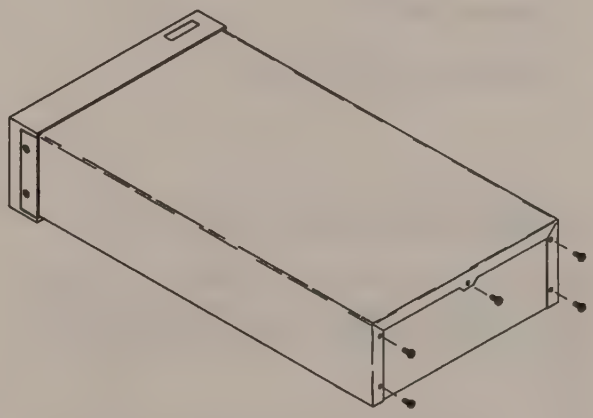


Figure 2.2 8440A-8443A Cover Mounting Screws

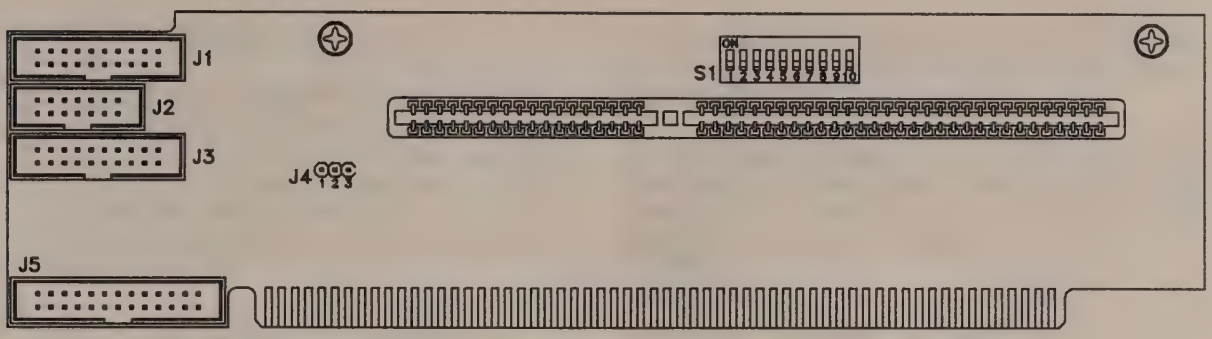


Figure 2.3 Switches and Jumpers on the Backplane Board

2.5 OPTION INSTALLATION

To install internal options, first remove the cover as explained in the previous section. Figures 2.4 and 2.5 illustrate the internal structure of the computer and the location of the various options.

RAM MEMORY

The two banks of Single-Inline Memory-Module (SIMM) sockets on the CPU board of the 8440A/8441A support main memory form 512K bytes to 16M bytes. The table below shows the available configurations:

BANK 0 SIMM Type	#	BANK 1 SIMM Type	#	Total Mem (M bytes)
256K	2	none	0	0.5
256K	2	256K	2	1.0
1M	2	none	0	2.0
256K	2	1M	2	2.5
1M	2	1M	2	4.0
4M	2	none	0	8.0
256K	2	4M	2	8.5
1M	2	4M	2	10.0
4M	2	4M	2	16.0

CAUTION: *Memory modules can easily be damaged by electrical charges stored on the human body. To protect against this danger, use one hand to pinch and hold the edge of the computer chassis throughout the installation procedure. Use the other hand to unwrap and install the part.*

A SIMM memory module is installed by inserting it vertically into the socket and then pivoting it back until it snaps in place. To remove a module, the snap catches at the ends of the socket must be spread gently just enough to allow the module to be removed. This must be done carefully, as overbending could cause the catches to break. As the SIMMs overlap, It is necessary to remove upper layers of SIMMs to install additional units in the lower layer sockets.

Once memory is physically installed, the BIOS setup facility must be used to reconfigure the system. See the BIOS setup section further on in this section.

Bank 0 (U48 and U49) and bank 1 (U46 and U47) are totally transparent on a system level, that is, SIMM pairs can be swapped around.

Main memory can be configured at the BIOS setup level to be PAGE mode, NON-PAGE mode/1-wait state, or NON-PAGE mode/0-wait state. In general, PAGE mode is a good compromise between memory cost and system performance. PAGE mode typically yields a throughput equivalent to 0.3 to 0.7 wait states with relatively slow RAM modules. The actual performance achieved is dependent on the software being executed, the size of the page (proportional to the size of the SIMM module), and whether interleave is active (possible only if both banks are loaded and contain the same size of SIMM).

Configuration in NON-PAGE mode will result in consistent throughput (always 0 or 1 wait state) regardless of the above factors, but requires use of faster SIMMs to achieve 0-wait performance.

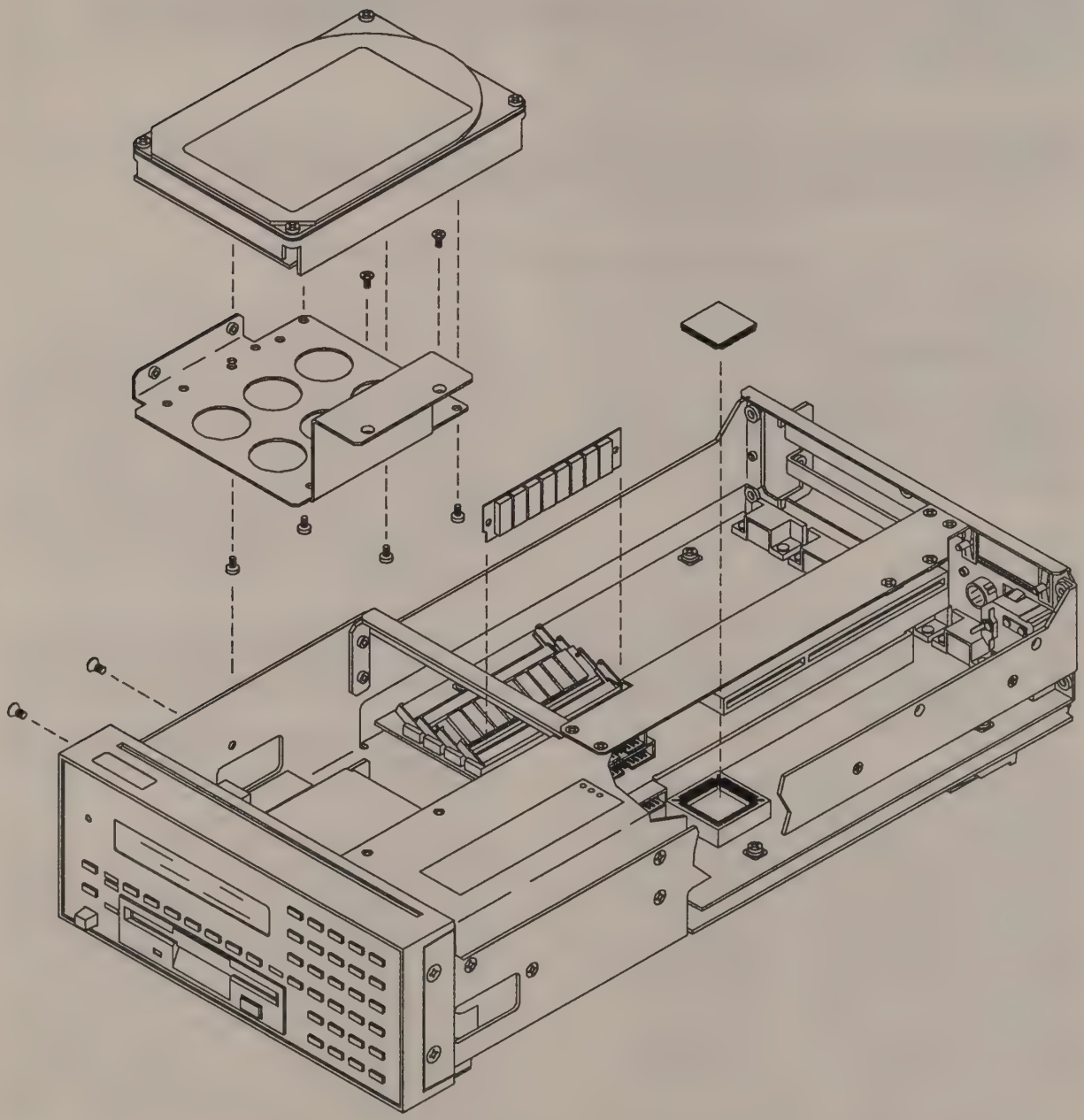


Figure 2.4 Option Installation

MATH COPROCESSOR

CAUTION: Math coprocessors can easily be damaged by electrical charges stored on the human body. To protect against this danger, use one hand to pinch and hold the edge of the computer chassis throughout the entire installation. Use the other hand to unwrap and install the part.

To install a math coprocessor, position the unit over the socket as shown in figure 2.4. One corner of the coprocessor is cut at an angle. It is essential that the angled corner of the coprocessor be aligned with the angled corner of the socket. The coprocessor is set over the top of the socket and pushed into the socket with the thumb. Make sure the coprocessor is fully and evenly seated on all sides.

DISK DRIVES

Figure 2.4 shows the assembly of the hard disk drive in the computer. Refer to this figure during the following steps. Begin by removing the existing drive (or the bracket only if no drive is present) according to the following steps.

Disk Drive Removal

CAUTION: Disk drives may be damaged by electrical charges stored on the human body. The best way to guard against this danger is through the use of a ground strap attached between the body and the computer chassis. If one is not available, contact the computer chassis frequently throughout the installation procedure, especially if you leave your seat during the procedure.

1. Remove the four screws securing the disk drive bracket in the computer. Two screws secure the bracket to the top of the power supply, while two more secure it to the left side of the computer chassis.

2. Push the disk drive backward and lift the unit out of the computer, front edge first. Unplug the power and signal cables from the rear of the drive, freeing the assembly from the computer.

3. Invert the assembly and remove the four screws securing the drive to the bracket. To protect the removed drive, it should be stored in an anti-static bag or wrapped in aluminum foil.

Disk Drive Installation

To install the new drive, follow these steps:

1. The drive mounting bracket has a variety of holes to accommodate different types of drives and mountings both through and behind the front panel. Determine the set of holes appropriate to the desired mounting and secure the drive to the bracket with screws of the correct size.

WARNING: drives from different manufacturers use screws of varying sizes, some English and some metric. Test the screws you intend to use by assuring that they turn easily into the threaded holes in the drive.

2. Turn the assembly upright, positioned with the rear of the drive tilted into the drive mounting space of the computer, and plug in the two cables. Insert the drive/bracket assembly fully into the mounting space by moving the rear backward and tilting the front down until it is in proper position.

3. Adjust the position of the drive assembly to align the bracket screw holes with the threaded holes in the top of the computer power supply and in the right side of the computer chassis. First install all of the screws loosely, and then tighten each.

The drive must be configured through the use of the BIOS setup facility explained later in this section. Drives which have not been previously formatted require an initialization process, also described further on in this section.

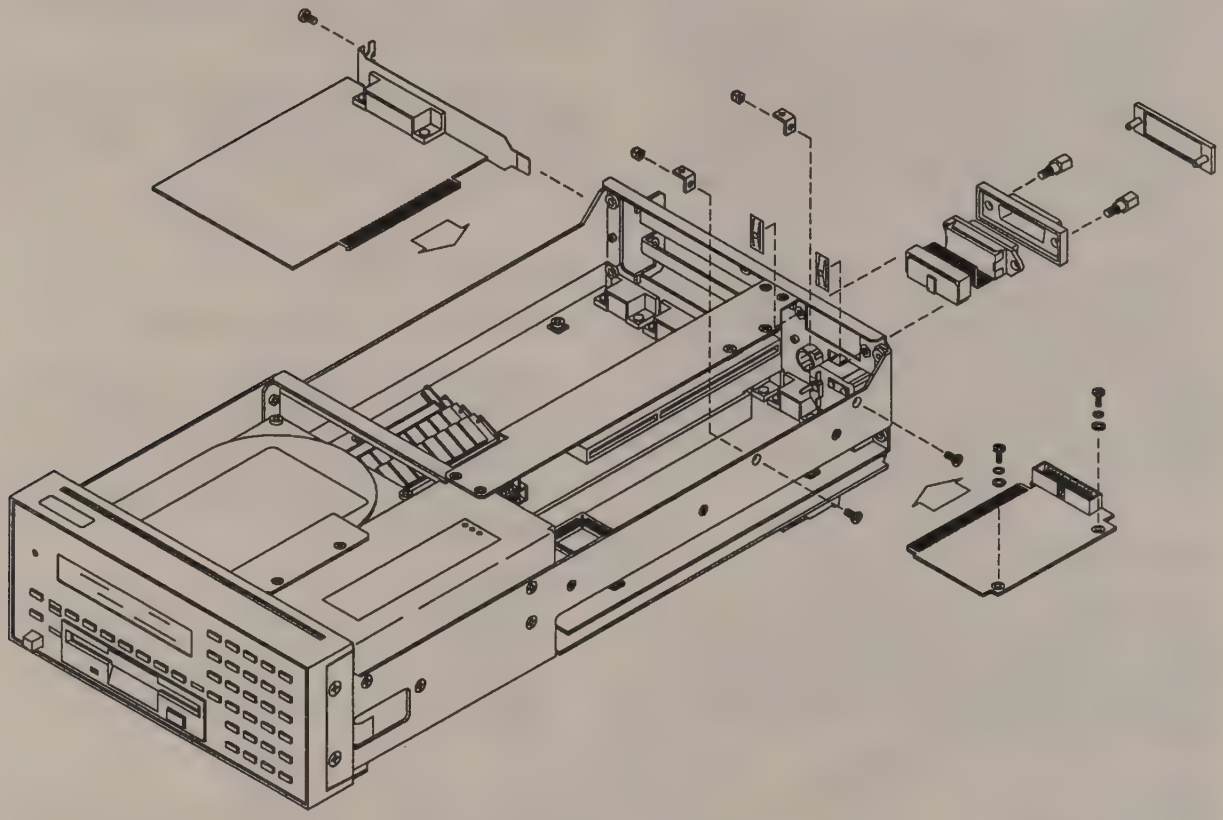


Figure 2.5 - GPIB and Option Card Installation

GPIB OPTION

Figure 2.5 Illustrates the installation of the GPIB option.

> ***CAUTION:*** *The GPIB option card circuitry can easily be damaged by electrical charges stored on the human body. To protect against this danger, use one hand to pinch and hold the edge of the computer chassis throughout the entire installation. Use the other hand to unwrap and install the part.*

GPIB Option Installation

To install the GPIB option, follow these steps:

1. Remove the plastic cover plate from the rear panel. This is accomplished by prying off the two speed nuts securing the plate.

2. Attach the two right angle brackets to the side of the chassis using the 4-40 x 5/16" flathead screws and 4-40 nylon insert nuts provided. Align the brackets so the top surfaces are parallel to the top edge of the chassis side.

3. Plug the GPIB option board into the edge connector of the backplane as shown in figure 2.5 with the components facing upward.

4. Secure the option board with the 4-40 x 1/4" pan head screws, #4 lock washers, and #4 flat washers provided.

5. Insert the GPIB connector and cable assembly

into the rear panel slot followed by the metal connector shell. The wider edge of the GPIB connector must be upward. Secure these components with the GPIB jackscrews provided, using a removable liquid threadlocker. Be careful not to overtighten the screws.

6. Plug the internal GPIB cable into the connector on the option circuit board.

OTHER OPTION CARDS

> ***CAUTION:*** *Option card circuitry can easily be damaged by electrical charges stored on the human body. To protect against this danger, use one hand to pinch and hold the edge of the computer chassis throughout the entire installation. Use the other hand to unwrap and install the part.*

Standard PC and PC-AT option cards up to 8.5" in length may be installed using the two option slots of the computer. To install a card, use the following procedure:

1. Remove the option slot cover plate for the slot to be used. To do this remove the 6-32 x 1/4" pan head screw securing the plate.

2. Insert the card into the option slot.

3. Secure the card using the 6-32 x 1/4" pan head screw previously removed.

CARRYING HANDLE

The carrying handle option is installed as follows (see figure 2.6):

1. Remove the 8-32 x 1/4" flathead screws from the sides of the front panel of the computer. Lift out the plastic side cover plates.

2. Insert the new side cover plates supplied with the handle kit. Secure these with the screws previously removed. Do not over tighten.

3. Position the handle around the front of the unit as shown in the figure and attach one side with the hardware as shown. The 8-32 x 1/2" oval head screw is inserted into the #8 dress washer, then the hole in the handle, through the #8 1/8" flat washer, and into the threaded hole in the side of the instrument. Do not fully tighten at this time.

4. Using the same hardware sequence, secure the other end of the handle. Tighten both screws until the handle pivots but has enough resistance to in the position to which it is pivoted.

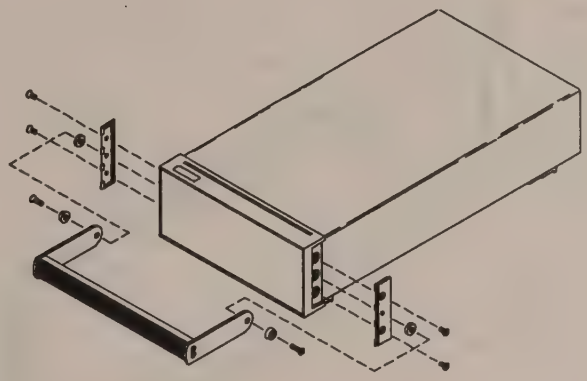


Figure 2.6 - Carrying Handle Installation

2.6 STACKING AND RACK MOUNTING

The 8440A-8443A and many other Maxus products use enclosures which are compatible with the Hewlett-Packard System II and System II+ Modular cabinets, and use similar hardware for rack-mounting, horizontal stacking, and vertical stacking.

Various methods of attaching and rack mounting these cabinets are illustrated in the following pages.

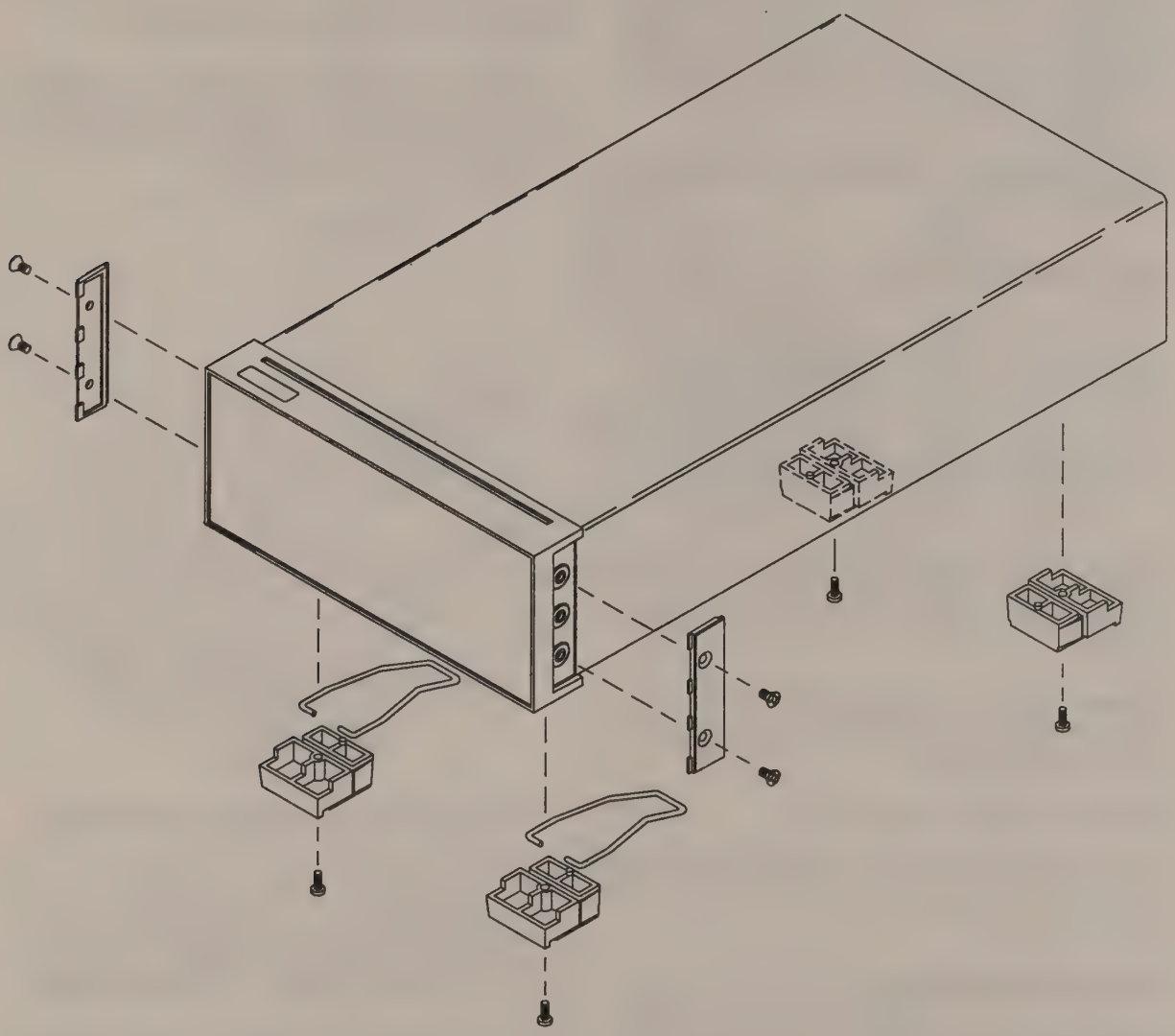


Figure 2.7 - Feet, Bails, and Side Cover Plates

CABINET FEET and BAILS

The feet are secured to the cabinet bottom with screws retained by the feet themselves. A pair of wire bails is provided to allow one end of the unit to be tilted up. Normally the bails are installed under the front feet so the front of the unit may be tilted up for easier access to the front panel during bench use. The bails may also be installed under the rear feet so the rear can be tilted up. This is useful is the unit is at the top of a tall stack of instruments.

Longer cabinets provide multiple foot mounting locations so that a long instrument may be stacked on top of a shorter one. In this instance, care must be taken by the user to insure that the resulting configuration is safe and stable.

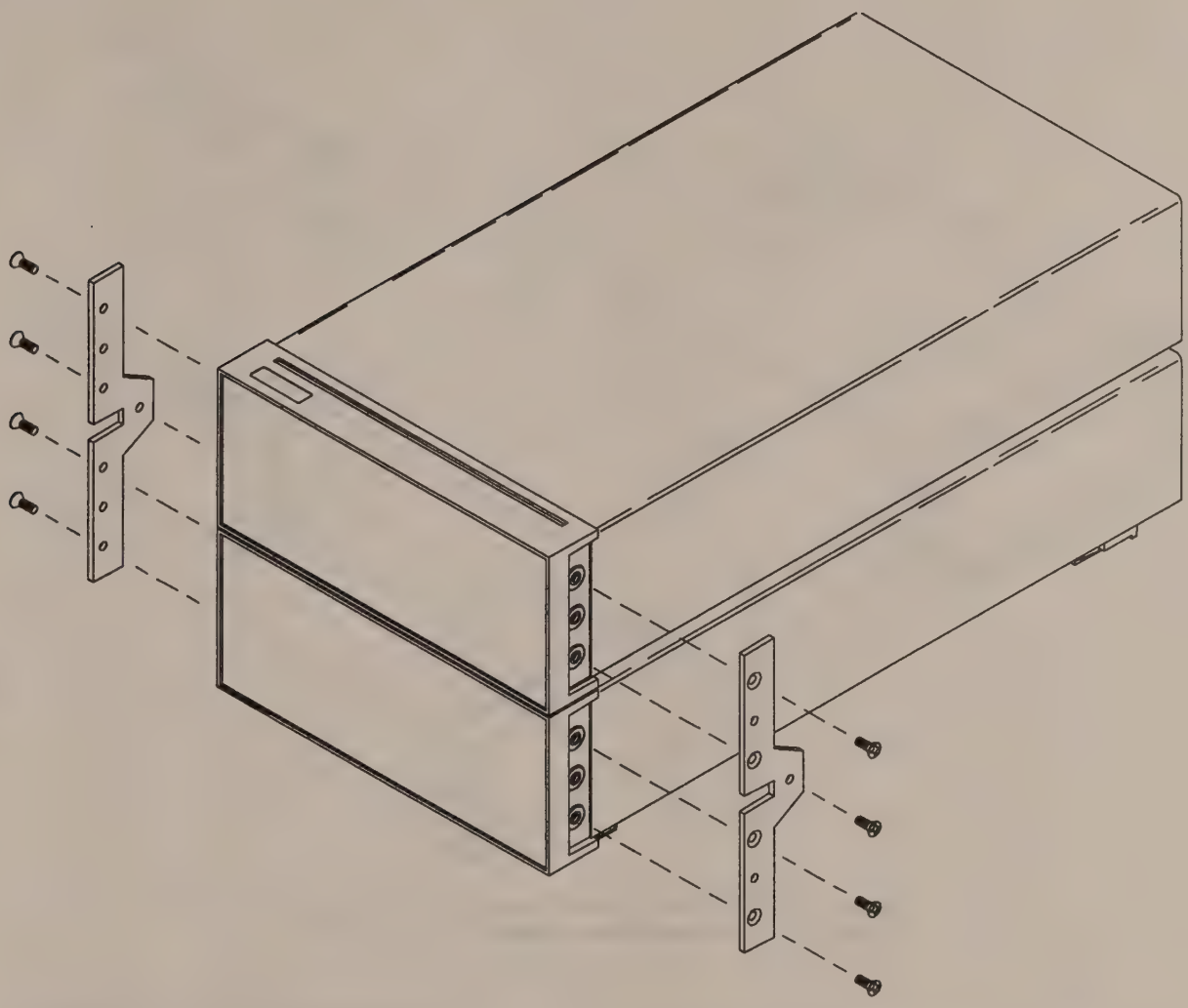


Figure 2.8 - Vertical Stacking

VERTICAL STACKING

To stack the 8440A-8443A vertically with another unit, the 81-900002 vertical stacking kit is used Refer to Figure 2.8 and follow this procedure:

1. Remove the feet from the upper unit and the side cover plates from both units (see figure 2.7).

2. Stack the units and attach a side stacking plate to each side of the pair using the 8-32 x 3/8" flat head screws provided. Note: If either unit is a Hewlett-Packard product, spacer plates (provided in the kit) must be installed under the stacking plates.

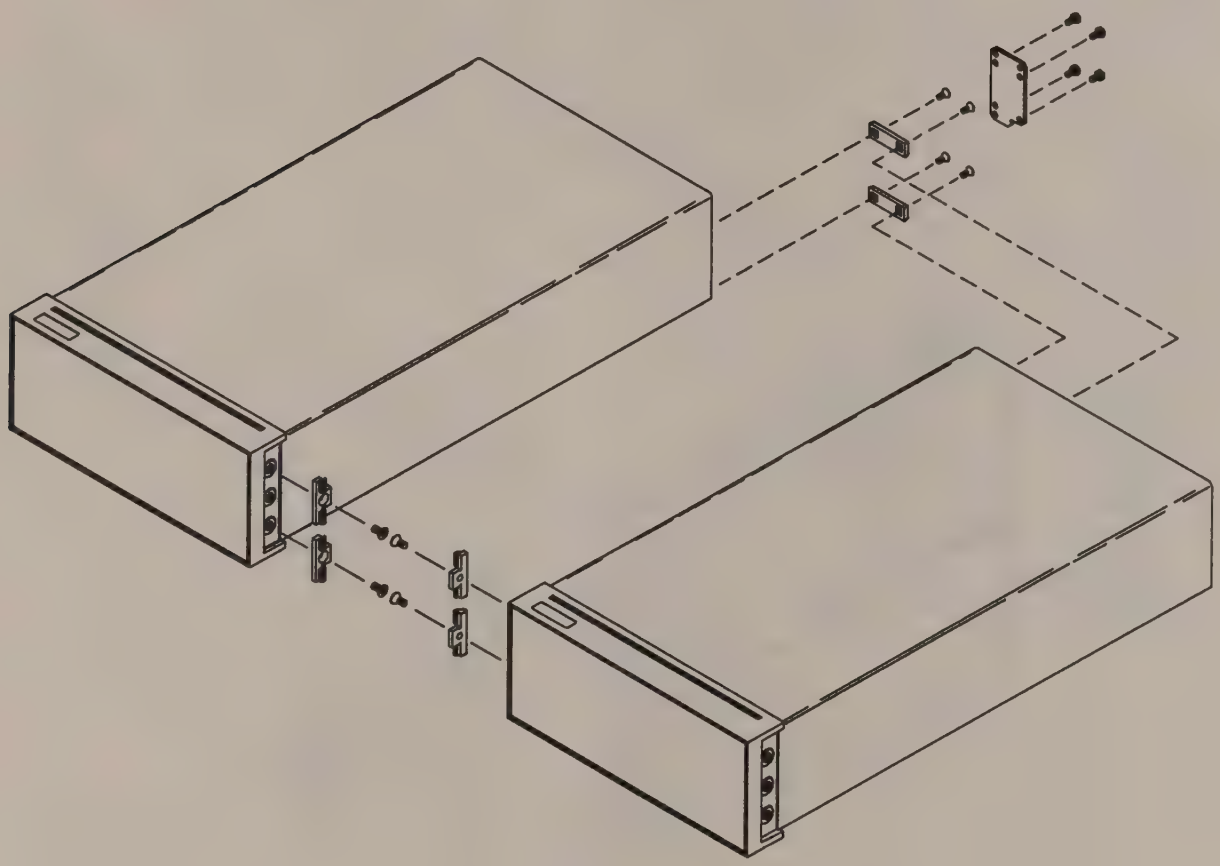


Figure 2.9 - Horizontal Stacking Identical Length Units

HORIZONTAL STACKING UNITS of IDENTICAL LENGTH

To stack the 8440A-8443A horizontally with another unit, the 81-900001 kit can be used. Dual unit rack mount kits 81-000352 through 81-000354 also include this hardware. Refer to Figure 2.9 and follow this procedure:

1. Attach two front horizontal lock links to opposite sides of the two units with two 8-32 X 1/4" SS flathead Phillips screws. Note that the links on the second unit must have the opposite orientation of those on the first unit.

2. Place the instruments side-by-side, locking the front lock links of the two units together.

3. Remove the rear cover screws from both units along the edges that will be adjacent to each other. The kit may include one of two types of rear hardware, either two links, or a single plate. If two links are provided, they are attached to the back panels with two 6-32 X 1/2" SS flathead Phillips screws each, utilizing holes previously occupied by the cover screws. If a single rear link plate is provided, it is attached using four 6-32 X 3/8" panhead Phillips screws each, in the same holes.

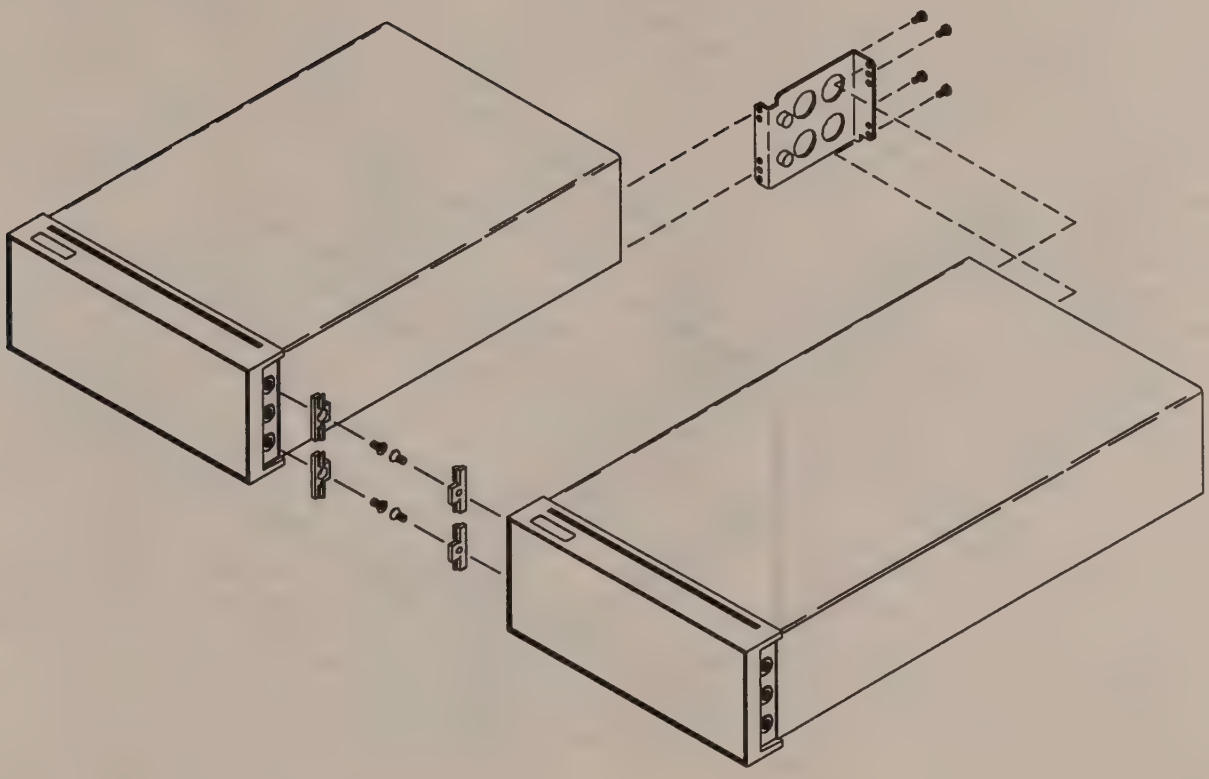


Figure 2.10 - Horizontal Stacking Units of Different Lengths

HORIZONTAL STACKING UNITS of DIFFERENT LENGTH

The 8440A-8443A may be stacked horizontally with other units of shorter or longer length. Maxus cabinets come in standardized sizes. To horizontally stack and rack mount cabinets differing in length by 3", 4.5", 6", and 7.5" use the 81-000353, 81-000354, and 81-000355 rack mounting kits respectively. Refer to Figure 2.9 and follow this procedure:

1. Attach two front horizontal lock links to opposite sides of the two units with two 8-32 X 1/4" SS flathead Phillips screws. Note that the links on the second unit must have the opposite orientation of those on the first unit.

2. Place the instruments side-by-side, locking the front lock links of the two units together.

3. Remove the rear cover screws from both units along the edges that will be adjacent to each other. Position the rear attachment bracket so that the plastic bumpers are against the side of the longer cabinet and the holes in the flanges of the bracket line up with the rear cover mounting holes. Attach the bracket to the rear panels with the four 6-32 X 3/8" panhead Phillips screws provided.

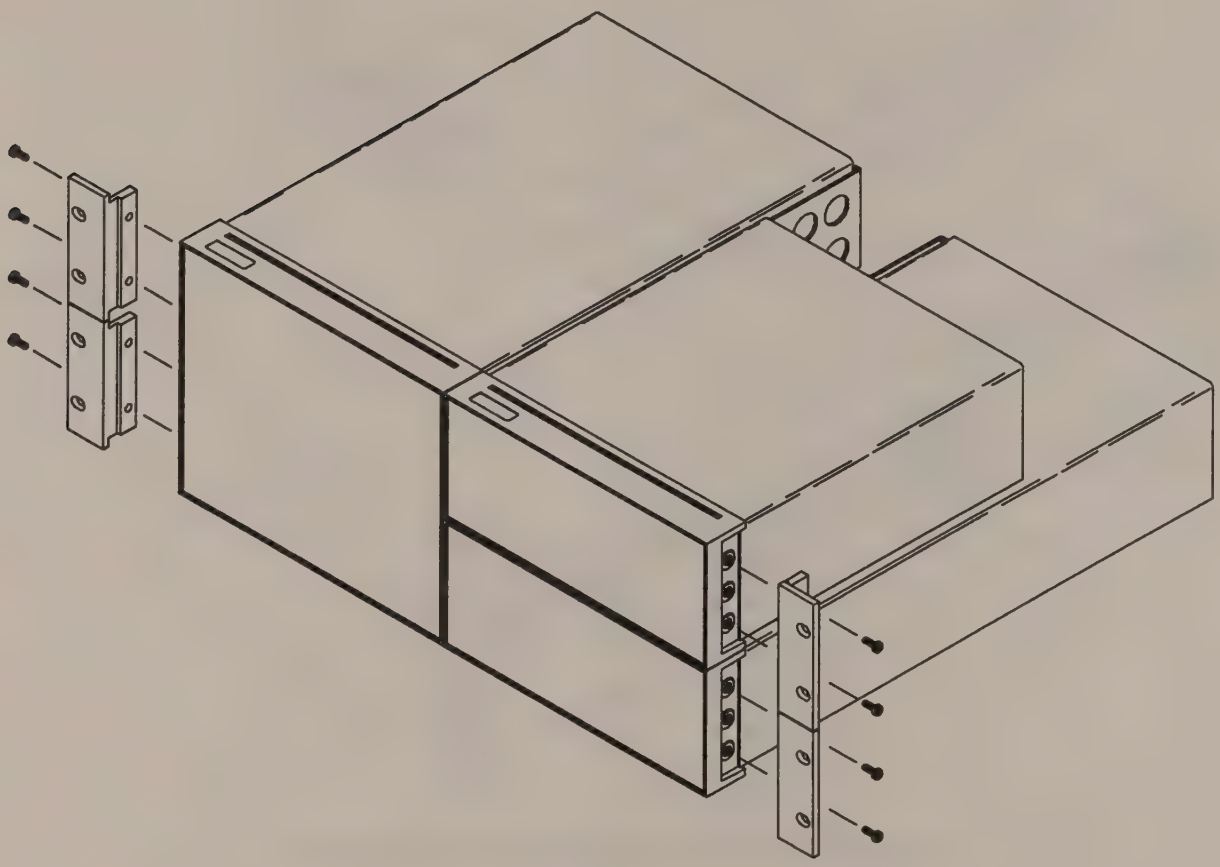


Figure 2.11 - Rack Mounting Stacked Units

RACK MOUNTING STACKED UNITS

Maxus products can be mounted in a wide variety of combinations with other Maxus products and with many Hewlett-Packard products. Figure 2.11 illustrates a typical combination. Rack ears can be attached as follows:

1.Horizontally stack the instruments to be mounted. (See previous discussion.)

2. Remove the feet and the side cover plates from each side of the front bezel.

3. Attach a rack mount flange to each side of the unit with two of the 8-32 X 1/2" panhead Phillips screws provided.

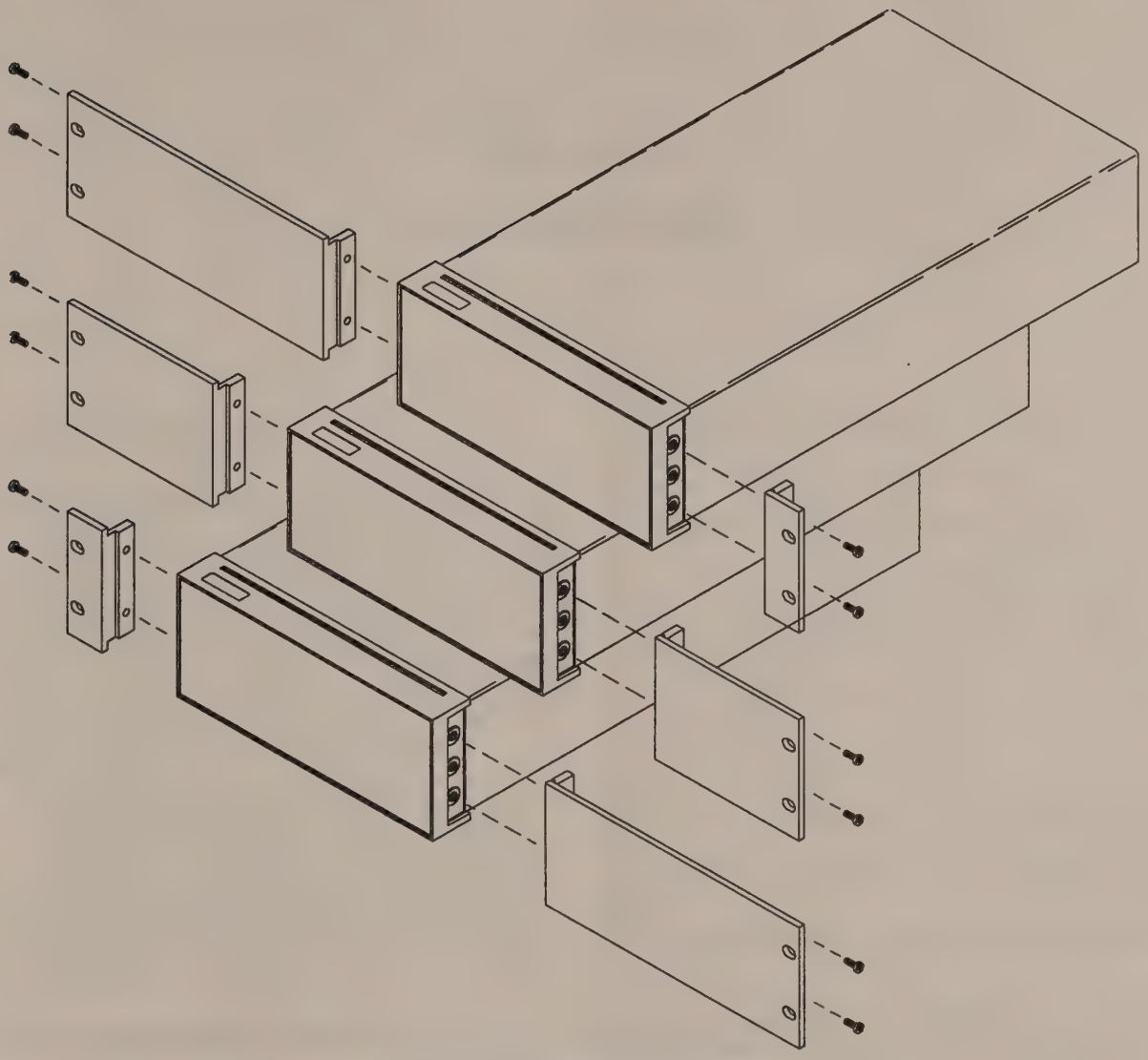


Figure 2.12 - Full Width Rack Mounting

FULL WIDTH RACK MOUNTING

The 8440A-84413 can be mounted alone in the full-rack configuration to the left or right or in the center. To mount the unit to the left or right, use the 81-000351 mounting kit. To mount the unit in the center use the 81-000358 kit. In all cases, refer to figure 2.12 and follow this procedure:

1.Horizontally stack the instruments to be mounted. (See previous discussion.)

2. Remove the feet and the side cover plates from each side of the front bezel.

3. Attach a rack mount flange to each side of the unit with two of the 8-32 X 1/2" panhead screws provided.

RACK MOUNTING A 7" TALL UNIT

A 7" tall half-rack width unit such as the Maxus 8406A-8407A displays can be mounted in the same fashion as a 3.5" tall unit by using two identical rack mounting kits.

SECTION 3.0

SYSTEM SETUP

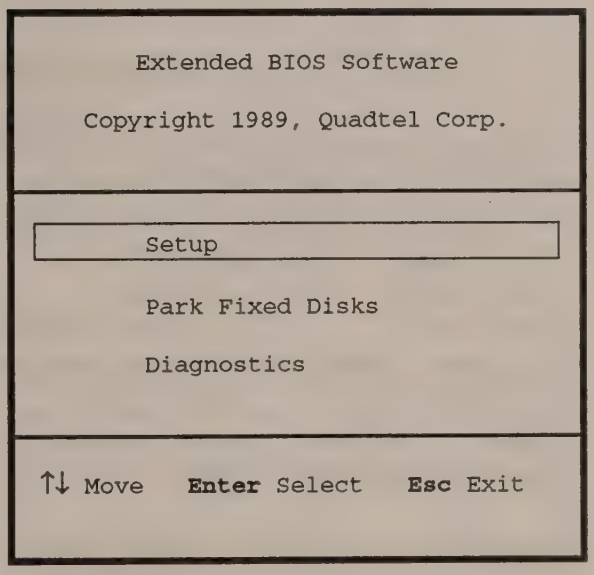
3.1 INTRODUCTION

Computers compatible with IBM PC and PC-AT standards require certain setup information to be stored in a specially allocated internal memory. This memory uses low power CMOS technology and is supported by a battery so that the content is retained when computer power is shut off. The first step of the set up process is to fill the necessary values into this memory using the BIOS setup facility. The second step is to format the hard disk, and the final step is to load user software.

> ***NOTE:*** *Most Maxus computers are shipped with the setup process already performed, ready for use. Systems which are stored for a long period before use may lose setup information but do not require disk formatting or reloading of software.*

3.2 THE BIOS SETUP FACILITY

To access to BIOS setup facility, turn on the computer, wait for the sign-on message to appear and the memory tests to complete, and type "S" on the keyboard while holding down the ALT and SHIFT keys. The following message box will appear:



Use the arrow keys to highlight the "Setup" selection, and press the enter key. This will cause the setup screen, shown below, to appear. The CTRL-ALT-S may be used to access the setup facility from within DOS applications but should be used with care, since the application will be immediately terminated without saving. Exiting setup always causes the computer to restart.

```
        Extended BIOS Setup - Copyright 1989, 1990 Quadtel Corporation

Current Date: [00/00/0000]              Video System:    [EGA/VGA  ]
Current Time: [00:00:00]                Power Up Speed: [Fast  ]

[  640K] System Memory                   BIOS Shadow: [System in RAM]
[ 3328K] Extended Memory                              [Video in ROM ]
    64K  Shadow Memory                   DRAM Access: [Page mode    ]
[   64K] EMS Memory

Internal COM A: [COM1, 3F8H][IRQ 4]  Internal Floppy:[Enabled   ]
Internal COM B: [COM2, 2F8H][IRQ 3]  Internal IDE:   [Enabled   ]
Internal LPT:   [LPT1, 378H][IRQ 7]
                                       System Memory Cache:  Off
Diskette Drive 0: [1.44 MB, 3 1/2]     Non-Cacheable Start:   4480K
Diskette Drive 1: [Not Installed ]     Non-Cacheable Size:    8192K

Fixed Disk 0: Type:[User] CY:[936] HD:[16] ST:[17] LZ:[  0] WP:[  0]
Fixed Disk 1: Type:[None]

↑↓  Move        F5  Previous Value      F9  Automatic Configuration
F1  Help        F6  Next Value          F10 Save Configuration
Esc Exit
```

CHANGING SETUP VALUES

The bottom section of the setup screen lists the keyboard keys which may be used to select and change setup values. The item selected is designated by a gray highlight. To select a different item, use the arrow keys (up, down, left, and right) or the <tab> key to move the highlight. All values may be decreased by using the F5 key and increased using the F6 key. The date, time, and fixed disk parameters also accept typed in numeric values and allow correction using the backspace key. Pressing F1 at any time will cause a "help" screen to be displayed with brief instructions for the currently selected item. Only items surrounded by square brackets may be modified.

AUTOMATIC CONFIGURATION

Pressing F9 will cause the system to be automatically configured. This will set default values for the system memory, extended memory, shadow memory, EMS memory, wait states, ROM/RAM BIOS control and video type. Auto configuration is not possible for the fixed disk or the diskette. These items must be configured manually.

Automatic configuration is especially useful if you are adding or subtracting memory. Simply add a memory board or add memory to the system board, invoke the setup utility and press F9 to set the proper memory configuration. The default values chosen when automatic configuration is selected are defined by your actual system configuration.

SAVING CONFIGURATION INFORMATION

Pressing F10 will save the current configuration. The configuration, with the exception of the time and date, is not saved until F10 is pressed. Press <Esc> to exit from the Setup program. If you have not saved settings, you can at this time.

SYSTEM CONFIGURATION PARAMETERS

Current Date

Sets the real time clock date for month, day of month, and year. This information is read by DOS to determine the current date.

Current Time

Sets the real time clock for hours, minutes, and seconds. During the power up sequence, the time is read from the real time clock and saved in the BIOS system time.

Video System

The video system can be set to one of four configurations. The video types are Monochrome, 40 column Color Graphics, 80 column Color Graphics, or Enhanced Graphics Adapter/VGA.

Power Up Speed

This option determines CPU speed at boot time: Fast (full speed) or Normal (8 MHz).

MEMORY CONFIGURATION PARAMETERS

System Memory

Sets the system memory size. The system memory size must be 256KB, 512KB or 640KB.

Extended Memory

This option sets the extended memory size in increments of 64KB. The maximum amount of extended memory is 15MB. See Setup RAM configuration below.

Shadow Memory

This option indicates the amount of memory to be used for shadow memory. Shadow memory is used to copy the system and/or video BIOS into RAM for improved performance. See Setup RAM configuration below.

EMS Memory

This allows you to set the amount of memory on the system board which should be used for EMS memory.

BIOS Shadow

Normally, the BIOS executes from EPROM. If shadow RAM is available, the BIOS can be copied into RAM and executed. This substantially increases the BIOS execution speed since the BIOS is running in 16-bit RAM rather than slower 8-bit EPROM.

DRAM Access

This feature allows the user to select either zero or one wait state for memory on the CPU board. Selecting zero wait states when one wait state is required may cause the system to malfunction.

System Memory Cache (486SLC version only)

Some programs may be incompatible with memory caching. This feature allows you to enable or disable memory caching.

Non-Cacheable Start (486SLC version only)

Sets the start of the non-cacheable memory region.

Non-Cacheable Size (486SLC version only)

Sets the size of the non-cacheable memory region.

PORT CONFIGURATION PARAMETERS

In general, it is best to use the automatic configuration (see above) to select the COM or LPT port for you. Automatic configuration will select the first logical port address which does not conflict with other communication ports in your system.

Internal COM A

This item selects the port address and the interrupt line which will be programmed by the BIOS for the internal COM port A. The port address may be selected to be COM1 (3F8H), COM2 (2F8H), COM3 (3E8H), COM4 (2E8H), or OFF. The interrupt may be selected to be IRQ 3, IRQ 4, IRQ 5, or OFF. The default setup for this port is COM1 (3F8H) on IRQ 4.

Internal COM B

This item selects the port address and the interrupt line which will be programmed by the BIOS for the internal COM port B. The port address may be selected to be COM1 (3F8H), COM2 (2F8H), COM3 (3E8H), COM4 (2E8H), or OFF. The interrupt may be selected to be IRQ 3, IRQ 4, IRQ 5, or OFF. The default setup for this port is COM2 (2F8H) on IRQ 3.

Internal LPT

This item selects the port address and interrupt line which will be programmed by the BIOS for the internal LPT port. The port address may be LPT1 (378H), LPT2 (278H), LPT1 (3BCH), or OFF, while the interrupt line may be IRQ5, IRQ7, or OFF. The default selection is LPT1 (378H) on interrupt line IRQ 7.

DISK CONFIGURATION PARAMETERS

Internal Floppy

This item determines if the internal floppy controller will be used. It may be enabled or disabled.

Internal IDE

This item determines if the internal IDE fixed disk drive controller will be used. It may be selected to be enabled or disabled.

Diskette Drive 0

Configures drive A to be 360KB, 1.2MB, 720KB, 1.44MB or not installed. The 360KB and 1.2MB types are 5 1/4" drives and the 720KB and 1.44MB types are 3 1/2" drives.

Diskette Drive 1

Configures drive B to be 360KB, 1.2MB, 720KB, 1.44MB or not installed. The 360KB and 1.2MB types are 5 1/4" drives and the 720KB and 1.44MB types are 3 1/2" drives.

Fixed Disk 0

Configures fixed Disk 0 to be one of 46 drive types, a user defined type, or not installed.

Fixed Disk 1

Configures fixed Disk 1 to be one of 46 drive types, a user defined type, or not installed.

For either of the fixed disk drives, if the "User" type is selected, the appropriate fixed disk parameters must be entered as follows:

CY: is the total number of drive cylinders

HD: is the total number of drive heads

ST: is the number of sectors per track

LZ: is the cylinder number to use as a landing zone

WP: is the cylinder number at which to begin write precompensation.

The standard drive types for which values may be selected are listed in the following table:

Type	CY	HD	ST	LZ	WP
1	306	4	17	305	128
2	615	4	17	615	300
3	615	6	17	615	300
4	940	4	17	940	512
5	940	6	17	940	512
6	615	4	17	615	-1
7	462	8	17	511	256
8	733	5	17	733	-1
9	900	15	17	901	-1
10	820	3	17	820	-1
11	855	5	17	855	-1
12	855	7	17	855	-1
13	306	8	17	319	128
14	733	7	17	733	-1
15	Reserved				
16	612	4	17	633	0
17	977	5	17	977	300
18	977	7	17	977	-1
19	1024	7	17	1023	512
20	733	5	17	732	300
21	733	7	17	732	300
22	733	5	17	732	300
23	306	4	17	336	0
24	612	4	17	663	0
25	612	2	17	612	300
26	614	4	17	614	-1
27	820	6	17	820	-1
28	977	5	17	977	-1
29	1218	15	36	1218	-1
30	1224	15	17	1224	-1
31	823	10	17	823	512
32	809	6	17	809	128
33	830	7	17	830	-1
34	830	10	17	830	-1
35	1024	5	17	1024	-1
36	1024	8	17	1024	-1
37	615	8	17	615	128
38	1024	8	26	1024	-1
39	925	9	17	925	-1
40	1024	9	17	1023	-1
41	918	15	17	917	-1
42	1024	15	17	1023	-1
43	823	10	34	822	-1
44	969	5	34	968	-1
45	969	7	34	968	-1
46	969	9	34	968	-1

3.3 FIXED DISK DRIVE FORMATTING

Before it can function properly in a system, a fixed disk drive must be formatted. There are two levels of formatting required, low and high. Low level formatting physically defines sector and bit locations on the disk surface. High level formatting initializes data in the sectors to some value dependent on the particular operating system.

Drives supplied by Maxus receive low level formatting at the factory. Most other suppliers of drives can supply a low level format utility. Maxus customer service is available if assistance is needed.

High level formatting is performed by utility programs supplied with the operating system. Refer to the manuals supplied with the operating system. Since MS-DOS (PC-DOS) is the most commonly used operating system, high level formatting instructions follow:

Formatting a New Fixed Disk

To prepare a new hard disk for use, it must first be formatted correctly. In order to do this, you must create a bootable MS-DOS diskette. To create a bootable MS-DOS diskette, perform the follow steps:

1. Place a diskette in drive A.

2. Type the following command to make the diskette bootable:

FORMAT A: /S

3. When the diskette has been formatted, copy the files FDISK.EXE and FORMAT.COM to the formatted diskette using the following commands:

COPY C:\DOS\FDISK.EXE A:

COPY C:\DOS\FORMAT.COM A:

When you have created the bootable diskette, remove the diskette from drive A: and switch off the computer.

Install the new hard disk according to the installation chapter at the end of this manual. Switch on the

computer and enter the SETUP mode by pressing the following keys

<Ctrl><Alt><S>

Enter the hard disk drive parameters according to the drive manufacturers instructions.

Insert the bootable MS-DOS diskette into drive A: and reboot the computer. When the "A>" prompt appears, type in the following command:

FDISK

The following screen will be displayed on the computer:

```
MS-DOS Version 5.0
Fixed Disk Setup Program
(C)Copyright Microsoft Corp. 1983 - 1991

FDISK Options

Current fixed disk drive: 1

Choose one of the following:

1.  Create DOS partition or Logical DOS Drive
2.  Set active partition
3.  Delete partition or Logical DOS Drive
4.  Display Partition information

Enter choice: [1]

Press Esc to exit FDISK
```

The default option is 1. Create DOS partition or Logical DOS Drive. Press <Enter> to select this option. The following screen will be displayed:

```
Create DOS Partition or Logical DOS Drive

Current fixed disk drive: 1

Choose one of the following:

1.  Create Primary DOS Partition
2.  Create Extended DOS Partition
3.  Create Logical DOS Drive(s) in the
    Extended DOS Partition

Enter choice: [1]

Press Esc to return to FDISK options
```

Select the default option (Create Primary DOS Partition) by pressing <Enter>. The following screen will be displayed.

```
Create Primary DOS Partition

Current fixed disk drive: 1

Do you wish to use the maximum available size for
a Primary DOS Partition
and make the partition active
(Y/N).....? [Y]

Press Esc to return to FDISK Options
```

You should normally allocate the entire hard disk to DOS unless you will be running another operating system e.g. UNIX. Press <Enter> to select **Y**. The following screen will be displayed:

```
System will now restart

Insert DOS system in drive A:
Press any key when ready . . .
```

Make sure the bootable MS-DOS diskette is still in drive A: and press any key. The system will re-boot. At the "A>" prompt type the following command to format the hard disk and make it bootable:

FORMAT C: /S

When the format is completed, remove the diskette from drive A: and type the following command to re-start the computer and boot from the newly formatted hard disk:

<Ctrl><Alt><Del>

3.4 INSTALLING THE OPERATING SYSTEM and USER SOFTWARE

See the operating system and application software manuals for installation details.

SECTION 4.0

OPERATION

4.1 FRONT PANEL CONTROLS and INDICATORS

The 8440A series computers feature two different front panel arrangements. The 8441A and 8443A panels (figure 4.1) include a minimal control set, while the 8440A and 8442A (figure 4.2) feature the minimal set plus a two line by 24-character LCD display and a subset of the IBM-PC-AT keyboard that includes the keys needed for data entry and menu selection.

8441A/8443A CONTROLS & INDICATORS

POWER - The power switch connects line power to the unit when in the depressed and locked position. Be certain that the line voltage switch has been set to the proper position before switching on power.

SPEED - This button allows the CPU speed to be changed. The "High" and "Low" indicator lamps indicate the speed chosen. The actual CPU speeds are a function of the CPU option chosen.

RESET - Pressing this button causes the CPU to reset, restarting all operations as if power had been removed and reapplied.

DRIVE ACTIVITY - This indicator, designated by the barrel shaped disk drive symbol, indicates that the fixed disk drive has been accessed to transfer data.

KEYBOARD LOCK - The keyboard lock switch is used to deny access to the computer by unauthorized users. The computer may be accessed when the switch is turned to the position showing a symbol for an open lock. Switching to the other position causes keyboard typing to be ignored.

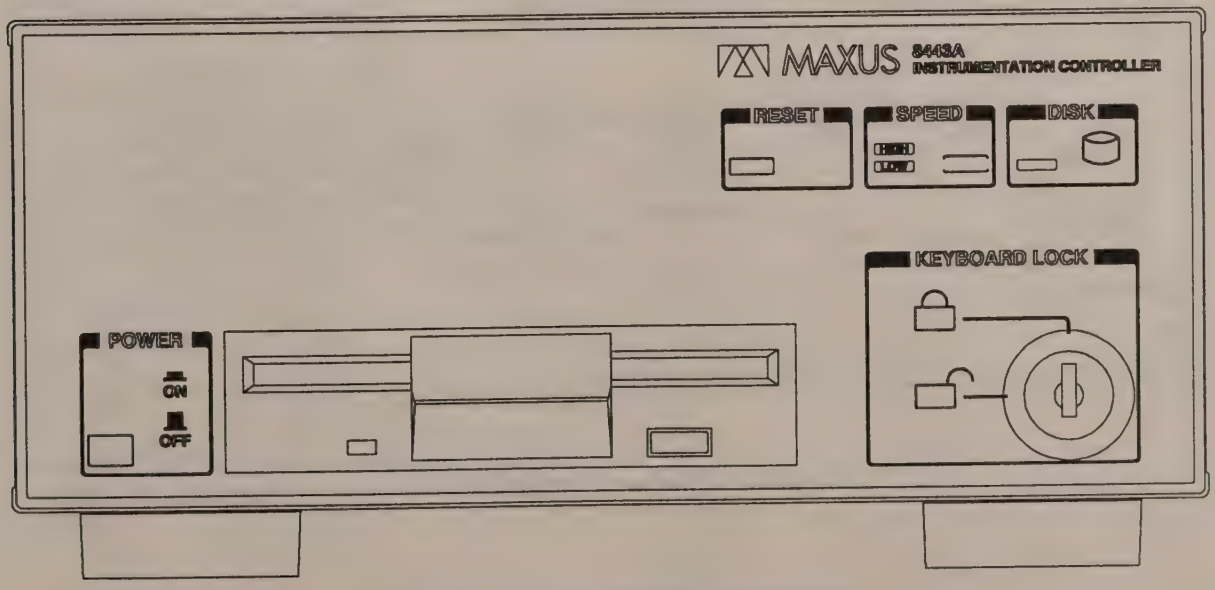


Figure 4.1 - The 8441A/8443A Front Panel

8440A/8442A CONTROLS & INDICATORS

The 8440A and 8442A front panels include the same controls as the 8441A and 8443A except the keylock switch. In addition, an LCD display and the following additional controls are implemented.

DATA ENTRY & FUNCTION KEYS - The data entry and function keys on the 8440A/8442A front panels operate in parallel with the keys of the full keyboard. For example, pressing F1 on the front panel will produce the same result as pressing F1 on a full sized keyboard plugged into the rear panel keyboard port. For many simple systems, the front panel keypad alone is adequate for operation.

The front panel shift key operates differently from that of a full keyboard. When the shift key is pressed, the key pressed after it will be shifted. The shift key must be pressed before each shifted entry. If the shift key is pressed a second time, the shift function is removed. The red symbols next to some keys on the front panel indicate the symbols entered for those keys when shifted. The shift is also active for the function keys. The up and down arrow keys can be shifted to obtain the page-up and page-down functions, and the BS key can be shifted to obtain the escape function.

PASSCODE FACILITY - The passcode facility consists of the front panel button and indicator and a bitswitch on the backplane board. When the bitswitch is on, a passcode may be entered from the keypad by pressing the passcode button (causing the indicator to light), and then entering a 7-digit passcode from the keypad. Once a passcode has been entered, the indicator will light each time the computer is turned on or reset, requiring the passcode to be entered before proceeding. When the bitswitch is off, the passcode facility is disabled and the old passcode is cleared. Note: to clear the passcode, the computer must be powered up at least once with the passcode bitswitch in the off position.

LCD DISPLAY - The two line by 24-character LCD display is accessed by software. The use of this display is a function of the software program controlling it.

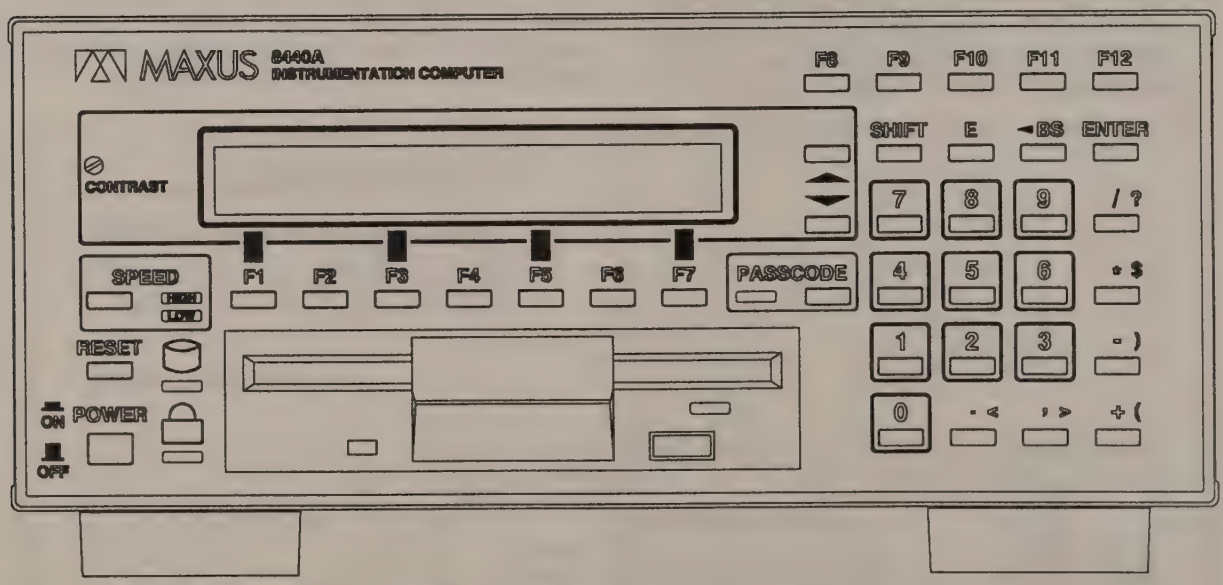


Figure 4.2 - The 8440A/8442A Front Panel

4.2 OPERATION

TURN-ON

To turn on the computer/controller, press the power switch until it latches. The unit will automatically run a series of internal tests and then try to start an operating system such as DOS, first from the A diskette drive, and then from the C fixed disk drive. Operation beyond this point is a function of the software installed on these disks. Refer to the manuals for the software in use for further operating instructions.

TURN-ON MESSAGES

As the system completes its initial tests, status is reported to the display. The messages listed below result from normal system startup. Other messages may occur if the system has not been properly set up or if a fault condition has occurred. A list of fault messages is given in the "Maintenance and Service" section.

System RAM Passed

This message will be displayed to indicate that the system memory test is occurring. The amount of RAM test (in KBytes) will be displayed before this message.

Extended RAM Passed

This message will be displayed to indicate that the extended memory test is occurring. The amount of RAM tested (in KBytes) will be displayed before this message. Not all systems may contain extended memory.

Shadow RAM Passed

This message will be displayed to indicate the shadow memory test is occurring. The amount of RAM tested (in KBytes) will be displayed before this message. Not all systems may contain shadow memory.

Press <Esc> to skip memory test ...

This will be displayed during the memory tests. Pressing <Esc> will cause the memory tests to be aborted. Memory will be zeroed as it would be on a soft reset. Do not press any key other than <Esc> or a keyboard error may result.

Press <F1> to resume, <F2> to Setup ...

This message will be displayed after any recoverable error message is displayed. Press <F1> to continue (start the boot process) or <F2> to enter the built-in SETUP program.

SECTION 5.0

TECHNICAL REFERENCE

5.1 INTRODUCTION

This section provides technical details of the 8440A-8443A Instrumentation Computers and Controllers. The information provided includes the following:

- Memory, I/O, and interrupt maps
- Explanations of system facilities
- Jumper and switch locations and settings
- Port addresses and pin-outs
- BIOS details

5.2 SYSTEM ORGANIZATION

PHYSICAL ARRANGEMENT

Maxus 8440A/8441A Instrumentation Computers and 8442A/8443A Instrumentation Controllers are completely compatible with IBM PCs, PC-ATs, and PS/2s. These units are based on a highly integrated CPU board that includes the processor and coprocessor, RAM, ROM, a PC-compatibility chipset, two serial ports, a parallel port, dedicated mouse and keyboard ports, and controllers for fixed disk, diskette, and super VGA display.

All front panel switches and indicators are mounted on a circuit board behind the plastic front bezel. The power supply is a self-contained module consisting of a circuit board and a sheet metal enclosure.

The backplane circuit board contains a PC-AT compatible 16-bit bus with two standard slots and a third specialized slot for Maxus options. The backplane board also contains the power-on reset generator, the -5V power regulator, the fan speed controller, and the interface to the front panel and LCD display of the 8440A and 8442A models.

MEMORY MAP

The main memory (RAM and ROM/EPROM) is organized according to the following table:

Memory Map

ADDRESS RANGE	SIZE	DESCRIPTION
00000-003FF	1K	Interrupt vectors
00400-9FFFF	640K	Main memory area
A0000-BFFFF	128K	VGA video buffer
C0000-C7FFF	16K	VGA video BIOS
C8000-CCFFF	20K	Fixed disk controller BIOS
CD000-CFFFF	12K	User PROM, memory mapped I/O
D0000-DFFFF	64K	User PROM, normal LIM expanded memory location
E0000-EFFFF	64K	User PROM
F0000-F7FFF	32K	BIOS setup & diagnostics
F8000-FFFFF	32K	BIOS
FFFF0-FFFF4	4	Startup vector
FFFF5-FFFFC	8	BIOS release date
FFFFE-FFFFF	2	Machine ID
100000-FFFFFF	15M	AT expanded memory

I/O MAP

In a PC, PC-AT, or PS/2 compatible computer, I/O devices are mapped into the 00000-003FF I/O address range. For most devices, only the lower ten bits, A0-A9 are decoded. The following table lists the standard assigned address ranges of common

devices. The devices implemented in the 8440A-8443A family are designated with an asterisk. Other popularly used devices are listed for convenience.

I/O Map

ADDRESS RANGE	SIZE	DESCRIPTION
00000-0000F	16	DMA controller #1, channels 0-3 (8237A)*
00020-00021	2	Interrupt controller #1, channels 0-7 (8259A)*
00040	1	Timer 0, time of day (8253)*
00041	1	Timer 1, RAM refresh (8253)*
00042	1	Timer 2, speaker (8253)*
00043	1	Timer control register (8253)*
00048-0004B	4	Maxus front panel keypad and LCD, default location*
00060-0006E even	8	Keyboard controller (8042)*
00061-0006F odd	8	Parallel peripheral interface (8255A), parity error and I/O channel check*
00070-0007F	8	Real time clock (MC146818)*
00080-00091, 00093-0009F	15	DMA page register (74LS612)*
00092	1	Alt A20 gate and hot reset*
000A0-000A1	2	Interrupt controller #2, channels 8-15 (8259A)*
000C0-000DE	16	DMA controller #2, channels 4-7 (8237A)*
000F0	1	Clear 287 BUSY
000F1	1	Reset 287/387SX
00200-0020F	16	Game and joystick port
00210-00217	8	Expansion unit
002E8-002EF	8	COM4 serial port
002F8-002FF	8	COM2 serial port*
00300-0031F	16	IBM prototype card
00378-0037F	8	LPT1 parallel printer port*
00380-0038F	8	SDLC serial port
003B0-003BF	16	VGA - Video graphics adapter*
003D0-003D7	8	CGA - color graphics adapter
003E8-003EF	8	COM3 serial port
003F0-003F7	8	Floppy disk (diskette) and IDE fixed disk controller*
003F8-003FF	8	COM1 serial port*

CHIPSET I/O MAP

The CPU board chipset contains a series of registers in addition to the standard PC ones. These are all located at multiples of address 00072H as listed in the table below. For further information, see the Western Digital data book for the WD76C10, WD76C20, and WD76C30.

Chipset I/O Register Map

ADDRESS	DESCRIPTION
01072	Clock control
01872	Bus timing and power down control
02072	Refresh control, serial and parallel chip selects
02872	Chip selects
03072	Programmable chip select address
03872	Memory control
04072	Non page mode DRAM timing
04872	Bank 1 and bank 0 start address
05072	Bank 3 and bank 2 start address
05872	Split start address
06072	RAM shadow and write protect
06872	EMS control and lower EMS boundary
07072	PMC output control 7-0
07872	PMC output control 15-8
08072	PMC timer
08872	PMC inputs 7-0
09072	NMI status
09872	Diagnostic register
0A072	Delay line
0B872	DMA shadow control
0C072	High memory write protect boundary
0C872	PMC interrupt enables
0D072	Shadow register
0E072	EMS page register pointer
0E872	EMS page register
0F072	48 MHz oscillator disable
0F472	48 MHz oscillator enable
0F872	Cache flush
0FC72	Lock status
0F073	Lock/unlock

INTERRUPT VECTORS

The following table describes the AT system interrupt vectors. The status column indicates whether the interrupt is directly supported by the BIOS.

Interrupt Vectors

INT	DESCRIPTION	STATUS
00	Divide by zero	No
01	Single step	No
02	Non-maskable interrupt	Yes
03	Breakpoint	No
04	Overflow	No
05	Print screen interrupt	Yes
06	Reserved	No
07	Reserved	No
08	IRQ0 - System timer interrupt	Yes
09	IRQ1 - Keyboard interrupt	Yes
0A	IRQ2 - VGA	No
0B	IRQ3 - Secondary serial port	No
0C	IRQ4 - Primary serial port	No
0D	IRQ5 - Secondary parallel interrupt	No
0E	IRQ6 - Floppy interrupt	Yes
0F	IRQ7 - Primary Parallel interrupt	No
10	BIOS video interface	Yes
11	BIOS request system information	Yes
12	BIOS request system memory size	Yes
13	BIOS fixed disk./diskette interface	Yes
14	BIOS serial interface	Yes
15	BIOS system functions interface	Yes
16	BIOS keyboard interface	Yes
17	BIOS parallel printer interface	Yes
18	BIOS secondary boot request	Yes
19	BIOS primary boot request	Yes
1A	BIOS system timer interface	Yes
1B	BIOS control break request	Yes
1C	BIOS user system timer interrupt	Yes
1D	BIOS video init parameters	Yes
1E	BIOS diskette parameters	Yes
1F	BIOS video graphics characters	Yes
40	BIOS diskette (with fixed disk)	Yes
41	BIOS fixed disk 0 parameters	Yes
46	BIOS fixed disk 1 parameters	Yes
70	IRQ8 - Real time clock interrupt	Yes
71	IRQ9 - reserved	No
72	IRQ10 - reserved	No
73	IRQ11 - reserved	No
74	IRQ12 - Mouse	Yes
75	IRQ13 - reserved	No
76	IRQ14 - reserved	No
77	IRQ15 - reserved	No

5.3 SYSTEM FACILITIES

CPU BOARD JUMPERS

Below is a summary of jumper/switch settings on the motherboard. In most circumstances, these jumpers should be left in their original default positions.

CPU Board Jumpers

LOCATION	SETTING
JP1	Off-board battery connector
JP2	OUT (default jumper out)
JP3	IN = color monitor selected
JP4	IN = disable on-board VGA (use with JP12)
JP5	IN = enable on-board mouse
JP6	IN = enable keyboard speed switching
JP7	IN = 800x600 - 56Hz OUT = 800x600 - 60Hz
JP8	IN = Multisynch-1 timing OUT = standard VGA timing
JP9	IN = PS/2 VGA mode OUT = AT VGA mode
JP10	IN (default jumper in)
JP11	IN (default jumper in)
JP12	IN = enable on-board VGA (use with JP4)
JP13	Turbo LED
JP14	External Turbo Switch
JP15	Reset Switch
JP16	Off-board speaker connector (Jumper at pins 1 and 2 to enable on-board speaker)
JP17	Pin 1 - Keyboard lock switch Pin 2 - Ground Pin 3 - Power-on LED anode Pin 4 - Ground Pin 5 - IDE active LED cathode Pin 6 - VCC Pin 7 - Not used Pin 8 - Key/not used

External Battery Connector

The 8440A-8443A contains a Ni-cad rechargeable battery to power the real time clock and CMOS RAM. The ni-cad battery lasts the life of the computer without needing replacement, but it can run down if the computer is left unpowered for a long period. Lithium batteries are available from many sources and can be plugged into JP1. They have higher capacity to maintain over long unpowered periods but eventually need to be replaced.

Display Selection

Jumpers JP2-4 and JP7-12 tell the system how to configure the internal monitor at power-up time.

On-board Mouse

JP5 is used to tell the system whether or not to use the internal PS/2 compatible mouse port. If the jumper is in (default), the internal port will be used.

Keyboard Speed Selection

JP6 will, if installed (default) allow the user to set the CPU speed from the keyboard. The "Slow" position forces the system to run at 8 MHz. The following key combinations are used:

Ctrl-Alt-<-> Switch to slow CPU speed

Ctrl-Alt-<+> Switch to fast CPU speed

Other CPU Jumpers

The other jumper posts on the CPU board, JP13-JP17 are used to attach various front panel features, including the speed selection button and LED, the reset button, an optional external speaker, the keylock switch (8441A and 8443A only), and the power and disk activity LEDs. The assignments for these items are listed in the table.

BACKPLANE BOARD JUMPERS and SWITCHES

Figure 5.1 illustrates the locations of the switches and jumper on the backplane circuit board viewed from the right side of the computer chassis. The jumper, J4, determines the CPU speed at startup. The default selection is with the jumper to the right (pins 2-3) for the high speed. Setting the jumper in the left position (pins 1-2) will cause the processor to start up in the slower speed.

Bitswitch 10 can be read by software as described in the subsection on the front panel LCD display and keypad. This switch is normally used to enable or disable the password protection mechanism.

The remaining bitswitches set the address of the front panel display and keyboard. Switches 1 through 9 correspond to address bits 9 through 1 respectively. A switch which is on (up) represents a value of zero and a switch which is off (down) represents a value of one. See the reference information section of this manual for further details.

KEYBOARD CONTROLLER

The motherboard incorporates a fully compatible AT class keyboard controller which also integrates PS/2 type mouse support. The on-board mouse uses the IRQ12 line; if this interrupt channel is to be allocated elsewhere, then the mouse can be disabled - freeing up the interrupt line - by removing the jumper shunt from the 2-pin male header connector referenced as JP5. Both the keyboard and the mouse are terminated to on-board PS/2 type 6-pin MINI-DIN female connectors (reference designators J1 [keyboard] and J2 [mouse]). Pin/signal assignment is listed below:

Keyboard Connections

PIN #	SIGNAL	I/O/B
1	DATA	B
2	NC.	
3	GROUND	(Power)
4	+5V	(Power)
5	CLOCK	B
6	no connection	

REAL TIME CLOCK

The motherboard supports includes an AT compatible real time clock and CMOS RAM. Both devices are supported by an on-board rechargeable NiCad battery.

In order to enhance battery life, the recharging circuit was designed to provide a "trickle charge". It is estimated that this will extend battery life beyond 5 years. (To fully charge the battery, it is recommended that the system is kept powered-up for a minimum of 72 hours. A fully charged battery will retain the contents of the CMOS memory for 45 to 60 days).

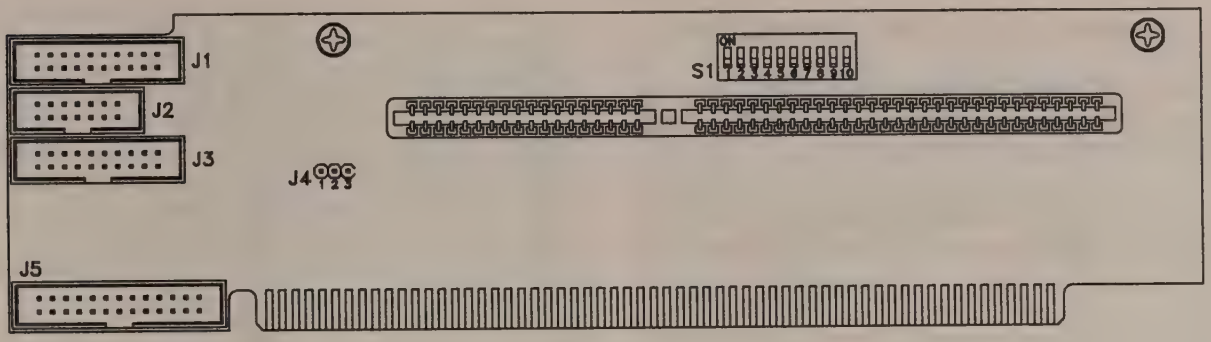


Figure 5.1 Switches and Jumpers on the Backplane Board

ISA BUS for PLUG-IN OPTION BOARDS

The 8440A series supports plug-in ISA compatible 16-bit cards. All slots feature the full 16-bit bus with both PC-AT connectors implemented. The CLK- signal is fixed at 8MHz. The connectors have two sections - A/B and C/D.

16-bit Expansion Bus - C/D Connector

PIN #	SIGNAL	PIN #	SIGNAL
C1	SBHE-	D1	MEMCS16-
C2	LA23	D2	IOCS16-
C3	LA22	D3	IRQ10
C4	LA21	D4	IRQ11
C5	LA20	D5	IRQ12
C6	LA19	D6	IRQ15
C7	LA18	D7	IRQ14
C8	LA17	D8	DACK0-
C9	MEMR-	D9	DRQ0
C10	MEMW-	D10	DACK5-
C11	SD8	D11	DRQ5
C12	SD9	D12	DACK6-
C13	SD10	D13	DRQ6
C14	SD11	D14	DACK7-
C15	SD12	D15	DRQ7
C16	SD13	D16	+5V
C17	SD14	D17	MASTER-
C18	SD15	D18	GND

16-bit Expansion Bus - A/B Connector

PIN #	SIGNAL	PIN #	SIGNAL
A1	IOCHK-	B1	GND
A2	SD7	B2	RSTDRV
A3	SD6	B3	+5V
A4	SD5	B4	IRQ9
A5	SD4	B5	-5V
A6	SD3	B6	DRQ2
A7	SD2	B7	-12V
A8	SD1	B8	0WS
A9	SD0	B9	+12V
A10	ICHRDY	B10	GND
A11	AEN	B11	SMEMW-
A12	SA19	B12	SMEMR-
A13	SA18	B13	IOW-
A14	SA17	B14	IOR-
A15	SA16	B15	DACK3-
A16	SA15	B16	DRQ3
A17	SA14	B17	DACK1-
A18	SA13	B18	DRQ1
A19	SA12	B19	REFRESH-
A20	SA11	B20	CLK
A21	SA10	B21	IRQ7
A22	SA9	B22	IRQ6
A23	SA8	B23	IRQ5
A24	SA7	B24	IRQ4
A25	SA6	B25	IRQ3
A26	SA5	B26	DACK2-
A27	SA4	B27	TC
A28	SA3	B28	BALE
A29	SA2	B29	+5V
A30	SA1	B30	OSC
A31	SA0	B31	GND

CPU BOARD BACKPLANE CONNECTOR

The CPU and backplane circuit boards are connected to each other through a 120-pin edge connector with the following pin-out.

CPU Board Backplane Connector

PIN #	SIGNAL	PIN #	SIGNAL
A1	+12V	B1	+12V
A2	GND	B2	+5V
A3	GND	B3	GND
A4	IOCHK-	B4	GND
A5	SD7	B5	RSTDRV
A6	SD6	B6	+5V
A7	SD5	B7	IRQ9
A8	SD4	B8	-5V
A9	SD3	B9	DRQ2
A10	SD2	B10	-12V
A11	SD1	B11	0WS
A12	SD0	B12	+12V
A13	ICHRDY	B13	GND
A14	AEN	B14	SMEMW-
A15	SA19	B15	SMEMR-
A16	SA18	B16	IOW-
A17	SA17	B17	IOR-
A18	SA16	B18	DACK3-
A19	SA15	B19	DRQ3
A20	SA14	B20	DACK1-
A21	SA13	B21	DRQ1
A22	SA12	B22	REFRESH-
A23	SA11	B23	CLK
A24	SA10	B24	IRQ7
A25	SA9	B25	IRQ6
A26	SA8	B26	IRQ5
A27	SA7	B27	IRQ4
A28	SA6	B28	IRQ3
A29	SA5	B29	DACK2-
A30	SA4	B30	TC
A31	SA3	B31	BALE
A32	SA2	B32	+5V
A33	SA1	B33	OSC
A34	SA0	B34	GND
A35	GND	B35	GND
A36	GND	B36	+5V
A37	+5V	B37	+5V
A38	SBHE-	B38	MEMCS16-
A39	LA23	B39	IOCS16-
A40	LA22	B40	IRQ10
A41	LA21	B41	IRQ11
A42	LA20	B42	IRQ12
A43	LA19	B43	IRQ15
A44	LA18	B44	IRQ14
A45	LA17	B45	DACK0-
A46	MEMR-	B46	DRQ0
A47	MEMW-	B47	DACK5-
A48	SD8	B48	DRQ5
A49	SD9	B49	DACK6-
A50	SD10	B50	DRQ6
A51	SD11	B51	DACK7-
A52	SD12	B52	DRQ7
A53	SD13	B53	+5V
A54	SD14	B54	MASTER-
A55	SD15	B55	GND
A56	GND	B56	GND
A57	GND	B57	GND
A58	GND	B58	+5V
A59	+5V	B59	+5V
A60	+5V	B60	+5V

DIRECT MEMORY ACCESS

The 8400 Series motherboard fully supports the AT class 7-channel DMA implementation.

INTERRUPT CONTROLLER

The sixteen channel PC-AT interrupt implementation is fully supported.

5.4 MEMORY SYSTEM

MAIN MEMORY

Two banks of Single In-Line Memory Modules (SIMM) sockets support on-board memory from 512KB to 16MB. Its flexibility, determined by how such sockets may be populated with readily available SIMMs is shown in the table below:

RAM SIMM Selections

BANK-0 SIMM	Qty	BANK-1 SIMM	Qty	TOTAL MEMORY
256K	2	X	0	0.5MB
256K	2	256K	2	1.0MB
1M	2	X	0	2.0MB
256K	2	1M	2	2.5MB
1M	2	1M	2	4.0MB
4M	2	X	0	8.0MB
256K	2	4M	2	8.5MB
1M	2	4M	2	10.0MB
4M	2	4M	2	16.0MB

Bank-0 (reference designators U48 and U49) and Bank-1 (U46 and U47) are totally transparent on a system level, that is, SIMM pairs can be swapped around. Further, main memory can be configured at the BIOS Setup level to be PAGE Mode, NON-PAGE Mode/1-WAIT STATE or NON-PAGE Mode/0-WAIT STATE.

Depending upon the availability and/or cost of SIMMs at the various rated speeds, i.e. 60ns, 70ns, 80ns, 100ns, etc., the appropriate Mode should be configured accordingly.

In general, PAGE Mode is a good compromise between cost and performance. On the average it will yield an equivalent of 0.3/0.7 WAIT STATE throughput and is fairly forgiving of slow SIMMs. Its actual throughput however, is highly dependent on:

- The actual software being executed, i.e. size and type of task,
- How the system is configure, i.e. size of the "FILES" and "BUFFERS" in the "CONFIG.SYS" file,
- The size of the page, i.e. the type of SIMM, 256K vs. 1M vs. 4M and
- Whether interleave is active - possible if and only if both Banks have the same type of SIMMs.

Configuring main-memory access in a NON-PAGE Mode will result in consistent throughput, i.e. either 0 or 1 WAIT STATE, regardless of the software, system configuration, SIMM type or interleave access - or lack thereof. Care however, should be taken in the selection of the appropriate speed rating of the SIMM to be used.

Because different memory chips/SIMM manufacturers have differing specifications - even for memory devices with the same speed rating - we cannot guarantee that all SIMMs for a given rating and regardless of the manufacturer, will provide reliable operation. Listed in the table below however, are general guidelines to be followed in the selection of "minimum" required speed ratings for SIMMs if NON-PAGE Mode scheme is selected:

Memory Wait State Selection

SYSTEM FREQ	0-WAIT	1-WAIT
12MHz	80ns	100ns
16MHz	60ns	100ns
20MHz	N.A.	100ns
25MHz	N.A.	80ns

5.5 I/O PORTS

SERIAL PORTS

Two RS-232 serial ports are incorporated on the CPU circuit board. Hardware interconnection is accomplished via a standard serial cable from the external peripheral to either of the two on-board 9-pin male DB-type connectors, reference designators J3(COM1) and J4(COM2). Pin/Signal assignments are listed below:

Serial Port Connectors

PIN #	SIGNAL	Direction
1	RLSD	I
2	RXD-	I
3	TXD-	O
4	DTR	O
5	GROUND	(Power)
6	DSR	I
7	RTS	O
8	CTS	I
9	RI	I

PARALLEL PORT

A Centronics compatible parallel communication port is incorporated on the CPU circuit board. Hardware interconnection is accomplished via a standard parallel cable from the external peripheral to the on-board 25-pin female DB-type connector (reference designator J5). Pin/Signal assignments are listed below:

Parallel Port Connector

PIN #	SIGNAL	Direction
1	STB	O
2	DATA BIT0	B
3	DATA BIT1	B
4	DATA BIT2	B
5	DATA BIT3	B
6	DATA BIT4	B
7	DATA BIT5	B
8	DATA BIT 6	B
9	DATA BIT7	B
10	ACK-	I
11	BUSY	I
12	PR	I
13	SLCT	I
14	AFD-	O
15	ERR-	I
16	INIT-	O
17	SLIN-	O
18	GROUND	(Power)
19	GROUND	(Power)
20	GROUND	(Power)
21	GROUND	(Power)
22	GROUND	(Power)
23	GROUND	(Power)
24	GROUND	(Power)
25	GROUND	(Power)

VIDEO PORT

The Video Graphics Adapter (VGA) port maintains backward compatibility with previous standards such as MDA, EGA, Hercules and AT&T6300. The VGA section can be fully disabled via two jumpers - JP12 with the shunt installed and JP4 without the shunt installed enables on-board VGA. Opposite to this will disable it and allow the use of an external video card.

The 512K video RAM implemented in the 8440A-8443A series support all of the standard VGA modes as well as the following Super-VGA modes: 600 x 400 x 256 colors (60Hz/31KHz), 640 x 480 x 256 colors (60Hz/31KHz), 800 x 600 x 256 colors (56Hz/35KHz or 60Hz/37KHz), and 1024 x 768 x 16 colors (88Hz/35Khz Interlaced)

Hardware interconnection is accomplished via an on-board standard VGA 15-pin female DB-type connector (reference designator J6). Pin/Signal assignments are listed below:

VGA Signal Connector

PIN #	SIGNAL	Direction
1	RED	O
2	GREEN	O
3	BLUE	O
4	N.C.	
5	GROUND	(Power)
6	GROUND	(Power)
7	GROUND	(Power)
8	GROUND	(Power)
9	GROUND	(Power)
10	GROUND	(Power)
11	N.C.	
12	N.C.	
13	HSYNC	O
14	VSYNC	O
15	N.C.	

The IBM VGA defined "Feature" connector is also supported via a 26-pin male header connector (reference designator J9). Pin/Signal assignment for this port is listed below:

VGA Features Connector

PIN #	SIGNAL	Direction
1	GROUND	(Power)
2	DATA BIT0	I
3	GROUND	(Power)
4	DATA BIT1	I
5	GROUND	(Power)
6	DATA BIT2	I
7	EPD	I
8	DATA BIT3	I
9	EFS	I
10	DATA BIT4	I
11	EFC	I
12	DATA BIT5	I
13	N.C.	
14	DATA BIT6	I
15	GROUND	(Power)
16	DATA BIT7	I
17	GROUND	(Power)
18	PCLK	I
19	GROUND	(Power)
20	BLANK-	O
21	GROUND	(Power)
22	HSYNC	O
23	N.C.	
24	VSYNC	O
25	N.C.	
26	GROUND	(Power)

FRONT PANEL KEYPAD and DISPLAY

The 8440A and 8442A feature a two line by 24-character LCD display and a keypad designed for data entry and menu selection. The keypad is supported with software built into the BIOS This software causes the front panel keypad to behave in the same way as would a full keyboard. Pressing F1 on the keypad has the same effect as pressing F1 on a full keyboard.

The LCD display includes an internal controller which handles scanning and character generation automatically. Control of the display consists of sending it the proper sequence of setup codes, and then sending the desired characters.

Selection

The keypad and LCD display operate independently, but share a common area of four locations in I/O address space. This address area is defined by bitswitches 1-8 on the backplane circuit board which correspond to address bits 9-2. A switch which is off represents a one. The default base address is 48H (decimal 72), corresponding to switches 4 and 7 off and 1, 2, 3, 5, 6, and 8 on. The following discussion assumes that the default base address is used. If the base address is changed, the other register addresses must be changed accordingly.

Keypad Interface

The keypad interface includes a single register at address 4AH (74 decimal), organized as follows:

Keypad Register

S10	FLAG	D5	D4	D3	D2	D1	D0
7	6	5	4	3	2	1	0

When a key is pressed, the flag is set to a one and the keycode appears in D5-D0. The flag is reset to 0 by writing any value to port 4AH (74 decimal). The value returned in bit 7, S10, represents the setting of bitswitch 10 on the backplane circuit board, and will be 0 if the switch is on or 1 if the switch is off.

The keycode value returned for each key is listed below:

Keypad Codes

KEY	CODE	KEY	CODE
0	00	F5	14
1	01	F6	15
2	02	F7	16
3	03	F8	17
4	04	F9	18
5	05	F10	19
6	06	F11	1A
7	07	F12	1B
8	08	F9	1C
9	09	F10	1D
.	0A	F11	1E
,	0B	F12	1F
+	0C	Passcode	20
-	0D	E	21
*	0E	BS	22
/	0F	Enter	23
F1	10	Shift	24
F2	11		
F3	12	↓	28
F4	13	↑	29

Backlight & Passcode LED Register

The backlight for the LCD display and the passcode LED can be controller via the backlight and passcode LED register, located at address 4BH (75 decimal). The corresponding light turns up when sent a one and off when sent a zero.

Backlight & Passcode LED Register

-	-	-	-	-	-	PASSCODE LED	BACKLIGHT
7	6	5	4	3	2	1	0

LCD Display Controller Registers

Two registers are implemented within the controller for the LCD display, the command register at address 48H (72 decimal) and the data register at address 49H (73 decimal). The LCD controller (Hitachi HD44780) refreshes the display automatically and generates the dot patterns for characters. It also contains a font RAM, allowing the user to synthesize non-standard character types.

LCD Display Commands

Nine commands are used to control the display.

CLEAR DISPLAY - Writes the "space" code (20H) into all display buffer locations, sets the display write address to zero, setting the cursor to the zero position.

Clear Display Command

0	0	0	0	0	0	0	1
7	6	5	4	3	2	1	0

RETURN HOME - Sets the display write address to zero, setting the cursor to the zero position.

Return Home Command

0	0	0	0	0	0	1	-
7	6	5	4	3	2	1	0

ENTRY MODE SET - Sets bits that control the method of data entry to the display. If one, I/D causes the display write address to increment when a character code is sent to the data register address. If zero, the write address decrements. If S is zero data enters successive display positions. If S is one, display shifting is enabled and I/D controls the shift direction, left if one and right if zero.

Entry Mode Set Command

0	0	0	0	0	1	I/D	S
7	6	5	4	3	2	1	0

DISPLAY ON/OFF - The display is on if D is one and off if D is zero (display buffer contents are not disturbed). The cursor is visible if C is one and not visible If C is zero. The cursor blinks when enabled if B is one and does not blink if B is zero.

Display On/Off Set Command

0	0	0	0	1	D	C	B
7	6	5	4	3	2	1	0

CURSOR or DISPLAY SHIFT - Shifts the cursor or the display left or right according to the following:

Cursor and Display Shift Bits

S/C	R/L	ACTION
0	0	Shifts the cursor position to the left
0	1	Shifts the cursor position to the right
1	0	Shifts the entire display to the left. The cursor follows the display shift.
1	1	Shifts the entire display to the left. The cursor follows the display shift.

Cursor or Display Shift Command

0	0	0	1	S/C	R/L	-	-
7	6	5	4	3	2	1	0

FUNCTION SET - DL sets the data length to 8 bits if one or 4 bits for zero. N sets the number of display lines to one line if zero and two lines if one. F sets the font type for 1 line displays only to 5 x 7 if zero or 5 x 10 if one (don't care bit for 2 line displays). This register is set to 38H for the standard display.

Function Set Command

0	0	1	DL	N	F	-	-
7	6	5	4	3	2	1	0

SET CG RAM ADDRESS - The LCD display controller includes a RAM based character generator in addition to the generator for the fixed character set. This command sets the read/write address for the internal character generator. Each of the eight programmable characters uses eight successive locations designated by the R bits of the command. The 000 through 110 addresses correspond to the top through the bottom rows of the character, while the 111 address represents the underline/cursor position. The AAA bits represent the three lower order bits of the character code. Data sent to the data register location after this command is executed will be sent to the character generator RAM until a Set Display RAM Address command must be executed.

Set CG RAM Address Command

0	1	A	A	A	R	R	R
7	6	5	4	3	2	1	0

SET DISPLAY RAM ADDRESS - This command sets the read/write address for the display buffer. After executing this command data writes will be directed to the display buffer.

Set Display RAM Address Command

1	A	A	A	A	A	A	A
7	6	5	4	3	2	1	0

READ BUSY FLAG and ADDRESS - If the 48H (72 decimal) address is read, the busy flag and the contents of the write address register are returned. The busy flag is one if the display controller is busy executing a previous instruction and zero if complete.

Read Busy Flag and Address Command

BF	A	A	A	A	A	A	A
7	6	5	4	3	2	1	0

LCD Command Sequences

Before data can be properly received by the display, initialization is required as follows:

1. Wait at least 15 mS. after reset to insure that the display will be ready for initialization, and then send 30H to the command port.

2. Wait at least 4.1 mS., and again send 30H to the command port.

3. Wait at least 100 uS., and again send 30H to the command port. The sequence of steps 1, 2, and 3 will assure proper reception of succeeding commands.

4. Wait for the busy flag to be low (using the Read Busy Flag and Address Command), and send the Function Set command with the desired settings (38H for the standard display).

5. Wait for the busy flag to be low, and send the Display Off command (08H).

6. Wait for the busy flag to be low, and send the Clear Display command (01H).

7. Wait for the busy flag to be low, and send the Entry Mode Set command with bits set as desired (06H for most applications.

8. Wait for the busy flag to be low, and send the Display On command with bits set as desired (0FH for blinking cursor enabled and display enabled).

Data can now be sent to the display as desired. Before each character sent, the busy flag should be tested and waited upon until zero.

LCD Character Codes

The character generator internal to the LCD display controller contains 124 English characters, 124 Japanese characters, and eight programmable characters. The English and programmable characters (*0 - *7) are listed in the following table.

#	Ch
00	*0
01	*1
02	*2
03	*3
04	*4
05	*5
06	*6
07	*7
08	*0
09	*1
0A	*2
0B	*3
0C	*4
0D	*5
0E	*6
0F	*7
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
1A	
1B	
1C	
1D	
1E	
1F	

#	Ch
20	sp
21	!
22	"
23	#
24	$
25	%
26	&
27	'
28	(
29	)
2A	*
2B	+
2C	,
2D	-
2E	.
2F	/
30	0
31	1
32	2
33	3
34	4
35	5
36	6
37	7
38	8
39	9
3A	:
3B	;
3C	<
3D	=
3E	>
3F	?

#	Ch
40	@
41	A
42	B
43	C
44	D
45	E
46	F
47	G
48	H
49	I
4A	J
4B	K
4C	L
4D	M
4E	N
4F	O
50	P
51	Q
52	R
53	S
54	T
55	U
56	V
57	W
58	X
59	Y
5A	Z
5B	[
5C	≠
5D	]
5E	^
5F	_

#	Ch
60	`
61	a
62	b
63	c
64	d
65	e
66	f
67	g
68	h
69	i
6A	j
6B	k
6C	l
6D	m
6E	n
6F	o
70	p
71	q
72	r
73	s
74	t
75	u
76	v
77	w
78	x
79	y
7A	z
7B	{
7C	|
7D	}
7E	→
7F	←

5.6 DISK DRIVES and CONTROLLERS

HARD DISK DRIVE

The system supports the integration of up to two AT compatible Integrated Drive Electronics (IDE) hard disks. Hardware interconnection is accomplished via a standard flat cable from the drive(s) to the on-board 40-pin male header connector (reference designator J11). Pin/Signal assignments are listed below:

IDE Fixed Disk Signal Connections

PIN #	SIGNAL	Direction
1	RESET-	O
2	GROUND	(Power)
3	DATA BIT7	B
4	DATA BIT8	B
5	DATA BIT6	B
6	DATA BIT9	B
7	DATA BIT5	B
8	DATA BIT10	B
9	DATA BIT4	B
10	DATA BIT11	B
11	DATA BIT3	B
12	DATA BIT12	B
13	DATA BIT2	B
14	DATA BIT13	B
15	DATA BIT1	B
16	DATA BIT14	B
17	DATA BIT0	B
18	DATA BIT15	B
19	GROUND	(Power)
20	N.C. (KEY)	
21	N.C.	
22	GROUND	(Power)
23	IOW-	O
24	GROUND	(Power)
25	IOR-	O
26	GROUND	(Power)
27	N.C.	
28	BALE	O
29	N.C.	
30	GROUND	(Power)
31	IRQ14	I
32	IOCS16-	I
33	ADDR BIT1	O
34	N.C.	
35	ADDR BIT0	O
36	ADDR BIT2	O
37	CS0-	O
38	CS1-	O
39	IDELED-	I
40	GROUND	(Power)

FLOPPY DISK DRIVE

Two AT compatible floppy disk drives are supported. These can be either 360KB, 5 1/4" or 1.2MB 5 1/4" or 1.44MB 3 1/2" type drives. System level communications to the floppy disk drive is done through standard AT defined I/O ranges and interrupt pointers. Hardware interconnection is accomplished via a standard flat cable from the drive(s) to the on-board 34-pin male header connector (reference designator J10). Pin/Signal assignments at the CPU circuit board connector are listed below:

Floppy Disk Signal Connections

PIN #	SIGNAL	Direction
1	GROUND	(Power)
2	RWC-/RPM-	O
3	GROUND	(Power)
4	N.C.	
5	N.C. (KEY)	
6	N.C.	
7	ROUND	(Power)
8	INDEX-	I
9	GROUND	(Power)
10	MO0-	O
11	GROUND	(Power)
12	DS1-	O
13	GROUND	(Power)
14	DS2-	O
15	GROUND	(Power)
16	MO1-	O
17	GROUND	(Power)
18	DIR-	O
19	GROUND	(Power)
20	STEP-	O
21	GROUND	(Power)
22	WDATA-	O
23	GROUND	(Power)
24	WE-	O
25	GROUND	(Power)
26	TRK0-	I
27	GROUND	(Power)
28	WP-	I
29	GROUND	(Power)
30	RDATA-	I
31	GROUND	(Power)
32	HS-	O
33	GROUND	(Power)
34	DSKCHG-	I

5.7 SYSTEM EPROM and BIOS

All computers compatible with IBM-PC and PC-AT standard include a BIOS. BIOS is an acronym for Basic Input/Output System. The BIOS is a set of software routines contained in the system ROM or EPROM. These routines provide a standardized method of handling I/O and other operations. The entry points to these routines are located in the same place for all compatible computers and are called by application software as needed.

The 8440A series CPU board incorporates a single EPROM device which integrates the System and Video BIOS. The system BIOS uses 64K of ROM from physical address F0000H to FFFFFH. The BIOS itself resides completely in the 32K portion of the BIOS from F8000H to FFFFFH. The 32K portion of the BIOS from F0000H to FFFFFH contains the Setup Utility and other BIOS components.

The video BIOS is located at the C0000-C7FFF memory range. If at least 1MB of Main Memory exists, then the shadowing of either BIOS into the on-board memory is possible - at the BIOS Setup level - and doing so will enhance the overall system performance. Note that if the Video section is to be shadowed, then the System section must also be shadowed.

At the BIOS Setup level, various system hardware configurations can be selected, either manually or automatically. Once done, the information is retained in the battery backed non-volatile CMOS memory section of the Real Time Clock. Note that such contents require change only if the hardware configuration has been modified or if the battery has lost power.

STRUCTURE

The BIOS in the Maxus 8440A series of computers/controllers comprises three distinct parts; the AT Compatible Core, the Hardware Adaptation Module and the BIOS Configuration Parameters.

The BIOS was designed so that the AT Compatible Core is always the same, and is a fully functional BIOS with thousands of working units in the field. Since the core is completely independent of the Hardware Adaptation Module, compatibility with industry standards is easily maintained in all configurations. The BIOS will perform from 6MHz to 33Mhz without any change to internal time-outs or delays.

The Hardware Adaptation Module works in conjunction with the AT Compatible Core. This module contains the code which is particular to the system board architecture. It will support any special hardware features such as shadow RAM, Cache and memory configurations.

The BIOS Configuration Parameters consist of a block of data which control the operation of the BIOS itself. These parameters contain information about memory configuration, what error messages should be displayed, and other information relating to how the BIOS should perform. BIOS Configuration Parameters can easily be modified by Maxus to allow maximum flexibility.

SETUP UTILITY and DIAGNOSTICS

In addition to the BIOS, the system EPROM also contains a setup facility and a complete set of diagnostic routines. These are described in the System Setup and Maintenance and Service sections respectively.

FIXED DISK TABLES

The Maxus BIOS supports a total of 46 drive types and two user definable drive types (Type 47). The user definable drive type allows the user to create drive parameters for both fixed 0 and fixed disk 1. Using the built-in SETUP program, you can specify the cylinders, heads, sectors, write precomp, and landing zone for a specific drive. With this feature, custom drive tables can be avoided and special software for supporting non-standard drives is usually unnecessary.

The user defined drive information is stored in the clock CMOS RAM. Before boot operation begins, fixed disk parameter tables are built at physical address 160H for drive 0 and 170H for drive 1.

Fixed Disk Parameters

Type	CY	HD	ST	WP	LZ
1	306	4	17	128	305
2	615	4	17	300	615
3	615	6	17	300	615
4	940	4	17	512	940
5	940	6	17	512	940
6	615	4	17	-1	615
7	462	8	17	256	511
8	733	5	17	-1	733
9	900	15	17	-1	901
10	820	3	17	-1	820
11	855	5	17	-1	855
12	855	7	17	-1	855
13	306	8	17	128	319
14	733	7	17	-1	733
15	Reserved				
16	612	4	17	0	633
17	977	5	17	300	977
18	977	7	17	-1	977
19	1024	7	17	512	1023
20	733	5	17	300	732
21	733	7	17	300	732
22	733	5	17	300	732
23	306	4	17	0	336
24	612	4	17	0	663
25	612	2	17	300	612
26	614	4	17	-1	614
27	820	6	17	-1	820
28	977	5	17	-1	977
29	1218	15	36	-1	1218
30	1224	15	17	-1	1224
31	823	10	17	512	823
32	809	6	17	128	809
33	830	7	17	-1	830
34	830	10	17	-1	830
35	1024	5	17	-1	1024
36	1024	8	17	-1	1024
37	615	8	17	128	615
38	1024	8	26	-1	1024
39	925	9	17	-1	925
40	1024	9	17	-1	1023
41	918	15	17	-1	917
42	1024	15	17	-1	1023
43	823	10	34	-1	822
44	969	5	34	-1	968
45	969	7	34	-1	968
46	969	9	34	-1	968

BIOS HOT KEYS

Beyond the standard key codes translated by the BIOS, the following Hot Keys have been added to the BIOS:

Ctrl-Alt-S	Enter the SETUP program
Ctrl-Alt-<->	Switch to slow CPU speed
Ctrl-Alt-<+>	Switch to fast CPU speed

BIOS INTERRUPTS

Access to the facilities contained in the BIOS is through a series of software interrupts. For further information, consult one of the many books written on the writing of software for MS-DOS systems. The book "The MS-DOS Encyclopedia" from Microsoft Press is recommended.

5.8 ASCII CONVERSION CHART

DECIMAL	HEX	BINARY	ASCII
1	0	00000000	NULL
2	1	00000001	SOH
3	2	00000010	STX
3	3	00000011	ETX
4	4	00000100	EOT
5	5	00000101	ENQ
6	6	00000110	ACK
7	7	00000111	BELL
8	8	00001000	BS
9	9	00001001	HT
10	A	00001010	F
11	B	00001011	VT
12	C	00001100	F
13	D	00001101	CR
14	E	00001110	SO
15	F	00001111	SI
16	10	00010000	DLE
17	11	00010001	DC1
18	12	00010010	DC2
19	13	00010011	DC3
20	14	00010100	DC4
21	15	00010101	NAK
22	16	00010110	SYN
23	17	00010111	ETB
24	18	00011000	CAN
25	19	00011001	EM
26	1A	00011010	SUB
27	1B	00011011	ESC
28	1C	00011100	S
29	1D	00011101	GS
30	1E	00011110	RS
31	1F	00011111	US
32	20	00100000	Spc
33	21	00100001	!
34	22	00100010	"
35	23	00100011	#
36	24	00100100	$
37	25	00100101	%
38	26	00100110	&
39	27	00100111	'
40	28	00101000	(
41	29	00101001	)
42	2A	00101010	*
43	2B	00101011	+
44	2C	00101100	,
45	2D	00101101	-
46	2E	00101110	.
47	2F	00101111	/

DECIMAL	HEX	BINARY	ASCII
48	30	00110000	0
49	31	00110001	1
50	32	00110010	2
51	33	00110011	3
52	34	00110100	4
53	35	00110101	5
54	36	00110110	6
55	37	00110111	7
56	38	00111000	8
57	39	00111001	9
58	3A	00111010	:
59	3B	00111011	;
60	3C	00111100	<
61	3D	00111101	=
62	3E	00111110	>
63	3F	00111111	?
64	40	01000000	@
65	41	01000001	A
66	42	01000010	B
67	43	01000011	C
68	44	01000100	D
69	45	01000101	E
70	46	01000110	F
71	47	01000111	G
72	48	01001000	H
73	49	01001001	I
74	4A	01001010	J
75	4B	01001011	K
76	4C	01001100	L
77	4D	01001101	M
78	4E	01001110	N
79	4F	01001111	O
80	50	01010000	P
81	51	01010001	Q
82	52	01010010	R
83	53	01010011	S
84	54	01010100	T
85	55	01010101	U
86	56	01010110	V
87	57	01010111	W
88	58	01011000	X
89	59	01011001	Y
90	5A	01011010	Z
91	5B	01011011	[
92	5C	01011100	\
93	5D	01011101	]
94	5E	01011110	^
95	5F	01011111	_

DECIMAL	HEX	BINARY	ASCII
96	60	01100000	`
97	61	01100001	a
98	62	01100010	b
99	63	01100011	c
100	64	01100100	d
101	65	01100101	e
102	66	01100110	f
103	67	01100111	g
104	68	01101000	h
105	69	01101001	i
106	6A	01101010	j
107	6B	01101011	k
108	6C	01101100	l
109	6D	01101101	m
110	6E	01101110	n
111	6F	01101111	o
112	70	01110000	p
113	71	01110001	q
114	72	01110010	r
115	73	01110011	s
116	74	01110100	t
117	75	01110101	u
118	76	01110110	v
119	77	01110111	w
120	78	01111000	x
121	79	01111001	y
122	7A	01111010	z
123	7B	01111011	{
124	7C	01111100	|
125	7D	01111101	}
126	7E	01111110	~
127	7F	01111111	DEL
128	80	10000000	
129	81	10000001	
130	82	10000010	
131	83	10000011	
132	84	10000100	
133	85	10000101	
134	86	10000110	
135	87	10000111	
136	88	10001000	
137	89	10001001	
138	8A	10001010	
139	8B	10001011	
140	8C	10001100	
141	8D	10001101	
142	8E	10001110	
143	8F	10001111	

DECIMAL	HEX	BINARY	ASCII
144	90	10010000	
145	91	10010001	
146	92	10010010	
147	93	10010011	
148	94	10010100	
149	95	10010101	
150	96	10010110	
151	97	10010111	
152	98	10011000	
153	99	10011001	
154	9A	10011010	
155	9B	10011011	
156	9C	10011100	
157	9D	10011101	
158	9E	10011110	
159	9F	10011111	
160	A0	10100000	
161	A1	10100001	
162	A2	10100010	
163	A3	10100011	
164	A4	10100100	
165	A5	10100101	
166	A6	10100110	
167	A7	10100111	
168	A8	10101000	
169	A9	10101001	
170	AA	10101010	
171	AB	10101011	
172	AC	10101100	
173	AD	10101101	
174	AE	10101110	
175	AF	10101111	
176	B0	10110000	
177	B1	10110001	
178	B2	10110010	
179	B3	10110011	
180	B4	10110100	
181	B5	10110101	
182	B6	10110110	
183	B7	10110111	
184	B8	10111000	
185	B9	10111001	
186	BA	10111010	
187	BB	10111011	
188	BC	10111100	
189	BD	10111101	
190	BE	10111110	
191	BF	10111111	

DECIMAL	HEX	BINARY	ASCII
192	C0	11000000	
193	C1	11000001	
194	C2	11000010	
195	C3	11000011	
196	C4	11000100	
197	C5	11000101	
198	C6	11000110	
199	C7	11000111	
200	C8	11001000	
201	C9	11001001	
202	CA	11001010	
203	CB	11001011	
204	CC	11001100	
205	CD	11001101	
206	CE	11001110	
207	CF	11001111	
208	D0	11010000	
209	D1	11010001	
210	D2	11010010	
211	D3	11010011	
212	D4	11010100	
213	D5	11010101	
214	D6	11010110	
215	D7	11010111	
216	D8	11011000	
217	D9	11011001	
218	DA	11011010	
219	DB	11011011	
220	DC	11011100	
221	DD	11011101	
222	DE	11011110	
223	DF	11011111	
224	E0	11100000	
225	E1	11100001	
226	E2	11100010	
227	E3	11100011	
228	E4	11100100	
229	E5	11100101	
230	E6	11100110	
231	E7	11100111	
232	E8	11101000	
233	E9	11101001	
234	EA	11101010	
235	EB	11101011	
236	EC	11101100	
237	ED	11101101	
238	EE	11101110	
239	EF	11101111	

DECIMAL	HEX	BINARY	ASCII
240	F0	11110000	
241	F1	11110001	
242	F2	11110010	
243	F3	11110011	
244	F4	11110100	
245	F5	11110101	
246	F6	11110110	
247	F7	11110111	
248	F8	11111000	
249	F9	11111001	
250	FA	11111010	
251	FB	11111011	
252	FC	11111100	
253	FD	11111101	
254	FE	11111110	
255	FF	11111111	

***Note**: ASCII is defined only for 7 bits; from decimal 128 to decimal 255 there are no ASCII equivalents.*

SECTION 6.0

MAINTENANCE & SERVICE

6.1 INTRODUCTION

The 8440A/8441A Instrumentation Computers and 8442A/8443A Instrumentation Controllers do not require preventative maintenance. All service should be referred to trained and qualified technical personnel or to the MAXUS customer service department.

Note: *Alerting components or using replacement parts other than those specified is not recommended and may void your warranty.*

6.2 ROUTINE CLEANING

To clean the cabinet wipe it with a cloth dampened with a mild soap solution or alcohol. Chemical solvents or other cleaning solutions may damage the cabinet finish or the plastic bezel.

6.3 REPLACING THE POWER FUSE

The power supply fuse is replaced as follows:

1. Unplug the power cord from the power module at the rear of the unit.

2. Use a small screwdriver to pull open the fuse drawer in the power module.

3. Eject the fuse by pushing a small screwdriver through the access port in the back of the fuse drawer.

4. Insert a replacement fuse of the same type and value. If you are changing the line voltage change the fuse to the proper rating for the new voltage, as listed on the serial number plate on the bottom of the unit.

5. Close the fuse drawer and reinstall the power cord.

Note: *If the fuse blows again, one or more power supply components are probably defective. Do not install another fuse or use a higher-rated fuse. Return the unit to the factory for service as described in the following section.*

6.4 FACTORY SERVICE

Should a Maxus product fail, the unit or defective module should be returned to the factory for repair. We strongly recommend that you do not undertake your own repairs. Our computer-based facilities enable complete diagnostic and functional testing while keeping repair time to a minimum.

If a product needs service after the warranty has expired, you will be charged for the repair parts and for the time our technicians spend to repair the unit at the prevailing hourly labor rate.

You must return the equipment to be repaired with shipping charges prepaid. We will pay for return shipping, provided the unit is under warranty; We will prepay shipping and bill you if the unit is out of warranty. We ship UPS, where available, or parcel post insured. A premium method of shipping can be used at your request.

To return a unit , please follow these steps:

1. Call the factory and discuss the problem with a customer support engineer.

2. If it is determined that the unit needs repair, the factory will issue a Return Materials Authorization (RMA) number.

3. Initiate a purchase order for the estimated repair charge if the unit is out of warranty.

4. Ship the unit with the RMA number and the name of your customer engineer to the factory.

PLEASE NOTE: *If you select the carrier, we will not assume any liability in connection with the shipment, nor shall the carrier be in any way construed as our agent.*

6.5 WARRANTY

We at MAXUS are proud of our excellent record in the design and manufacture of reliable products. Our warranty reflects our record: For one year from the date of shipment, the 8440A-8443A are warranted against defects in workmanship and materials while under normal service. During the warranty period, We will repair or replace, at our option, warranted equipment found to be defective in workmanship or materials.

This warranty may be voided by the use of replacement parts not specified in this manual or by the unauthorized alteration of the product.

6.6 CUSTOMER SUPPORT

If you have questions about your application or implementation after reading the manual, Please contact one of our customer support engineers at the factory. They are ready to assist you in implementation of any of our products.

6.7 TURN-ON FAILURE MESSAGES

POST ERRORS

When an error occurs during the power on self test (POST), the system BIOS will display an error message describing the problem. The message should explain the problem in sufficient detail so that the problem can be corrected.

Two additional recoverable errors are audible rather than displayed. The audible error generated during POST is one long tone followed by two short tones. This audible error will result from either a failed video configuration or an invalid external ROM module that does not properly checksum to zero. Any other audible errors consisting of one long tone followed by a series of short tones will be from an external ROM module (e.g. VGA).

80287 or 80387 Internal Register Error

This error will be displayed if the BIOS POST math coprocessor tests fail.

Bad Diskette Boot Record - Press any key

This error will be displayed if the BIOS loads the boot record from a diskette and finds it incompatible for booting. Replace the diskette in the drive with a compatible diskette and press any key. The BIOS will re-attempt the boot operation.

Color graphics adapter error

This error will be displayed if the color adapter fails its power-on tests.

Diskette drive A error

This error will be displayed if diskette drive A is present, but fails the BIOS POST diskette tests. Check to see that the proper diskette type is defined with SETUP and that the diskette drive is attached correctly. This error can occur for both diskette drives A or B.

Diskette error - Press any key

This message will be displayed if a fixed disk is not present and the BIOS cannot boot from the diskette drive. This can be caused by the lack of a working diskette in the drive or the diskette drive door being open. If the error is correctable, press any key and the BIOS will attempt the boot operation again.

Extended RAM Failed at offset:

This error will be displayed in the event that a RAM error is detected in extended memory. Above this message, the address which failed will be displayed. This message will show the offset in the 64K block at which the error occurred.

Failing bits

This message will show a hex number which is a map of the bits which have failed the memory (System, Extended or Shadow). Each bit if the number displayed which is a One is a failed bit.

Fixed Disk 0 Failure

This error will be displayed if fixed disk 0 is present but fails the BIOS POST fixed disk tests. Check to see that the proper fixed disk type is defined with SETUP and that the fixed disk is attached correctly. This error can occur for fixed disk drives 0 or 1.

Fixed Disk Controller Failure

This error will be displayed if the fixed disk controller test in the BIOS POST fails. The fixed disk controller may need to be replaced.

Incorrect drive A type - Run SETUP

This error is displayed to indicate that the drive type detected in drive A (or drive B) does not match the drive type set by SETUP in CMOS.

Keyboard controller error

The keyboard controller during POST has failed if this message is displayed. The keyboard controller or the keyboard may need to be replaced or the system board may need to be repaired.

Keyboard error

This error will be displayed if a stuck key is found during BIOS POST. The scan code of the key will be displayed before the error message.

Keyboard locked - Unlock key switch

The message will be displayed if the keylock is on. Unlock the system keylock to proceed.

Memory size does not match CMOS - Run SETUP

This error will be displayed if the extended memory size stored in the CMOS memory by the built-in SETUP program does not match the amount of memory found by the BIOS. If the amount of memory found by the BIOS is correct, run SETUP and change the amount of extended memory to reflect the amount actually in the system. If the amount detected by the BIOS is not what you expected, check for a memory board or system board configuration problem.

Monitor type does not match CMOS - Run SETUP

This error will be displayed of the monitor adapter type does not match the type specified in the SETUP program and stored in CMOS memory. For example, if the SETUP is setup to monochrome (built-in display is VGA), this error will be displayed. Run the SETUP program and set the correct monitor type.

Parity Check 1

This error will be generated if a parity error is detected on the system board. The BIOS will attempt to locate the address which caused the parity error and display it on the screen. If it cannot locate the address causing the error, if will display "????" instead.

Parity Check 2

This error will be generated if a parity error is detected on the I/O channel. The BIOS will attempt to locate the address which caused the parity error and display it on the screen. If it cannot locate the address causing the error, if will display "????" instead.

Previous boot was incomplete

This error will be displayed if the BIOS POST operation was terminated by a reset or power down before it was completed. On some systems (especially those with wait state control), this can be caused by an incorrect system configuration. Run SETUP and verify that the configuration is correct. This error will be cleared automatically the next time the system is re-booted.

Real time clock error

This error will be displayed if the real time clock test fails during BIOS POST operation. The system board may need to be repaired.

Shadow RAM Failed at offset:

This error will be displayed in the event that a RAM error is detected in shadow memory. Above this message, the K address which failed will be displayed. This message will show the offset in the 64K block at which the error was detected.

System CMOS checksum bad - Run SETUP

This error will be displayed if the CMOS has been modified incorrectly. This can be caused by a software program which modifies the CMOS memory or if the CMOS becomes corrupted. Run the SETUP program to re-configure the system.

System battery is dead - Replace and run SETUP

This error will be displayed if the CMOS clock battery indicator shows that the battery is dead. The battery should be replaced and SETUP run to re-configure the system.

System RAM failed at offset:

This error will be displayed in the event that a RAM error is detected in the system memory. Above this address, the K address which failed will be displayed. This message will show the offset in the 64K block at which the error was detected.

System timer error

This error will be displayed if the system timer test fails. The system may need to be repaired.

System cache error - cache disabled

On system with cache, this error indicates that the RAM cache system failed the BIOS test. The BIOS has disabled the cache.

6.8 BIOS CHECKPOINT CODES

During the POST, the BIOS signals a checkpoint by outputting a code to I/O address 80H. This code can be used to establish how far the BIOS executed through the power-on sequence and what test is currently being performed. This can be of great assistance in troubleshooting. Diagnostic cards are available which display the checkpoint code, and the code may also be observed using a logic analyzer.

If the BIOS detects a terminal error condition, it will halt the POST process and attempt to display the checkpoint code to the screen. The checkpoint code written to the screen will match the code written to port 80H. The code will be written repeatedly to the screen.

If the system hangs before the BIOS detects a terminal error, the value at port 80H will be the last test performed. In this case the terminal error cannot be displayed on the screen.

The following is a list of checkpoint codes which are written before their respective tests:

BIOS Checkpoint Codes

CODE	ERROR
02	Flag test
04	Register test
06	System hardware initialization
08	Initialize chip registers
0A	BIOS ROM checksum
0C	DMA page register test
0E	8254 timer test
10	8254 timer initialization
12	8237 DMA controller test
14	8237 DMA initialization
16	Initialize 8259 / Reset co-processor
18	8259 interrupt controller test
1A	Memory refresh test
1C	Base 64KB address test
1E	Base 64KB memory test
20	Base 64KB test (upper 16 bits)
22	8742 keyboard self test
24	MC146818 CMOS test
26	Start first protected mode test
28	Memory sizing test
2A	Autosize memory chips
2C	Chip interleave enable test
2E	First protected mode test exit
30	Unexpected shutdown
32	System board memory size
34	Relocate shadow ram if configured
36	Configure EMS system
38	Configure wait states
3A	Retest 64KB base RAM
3C	CPU speed calculation
3E	Get switches from 8042
40	Configure CPU speed
42	Initialize interrupt vectors
44	Verify video configuration
46	Initialize video system
48	Test unexpected interrupts

CODE	ERROR
4A	Start second protected mode test
4C	Verify LDT instruction
4E	Verify TR instruction
50	Verify LSL instruction
52	Verify LAR instruction
54	Verify VERR instruction
56	Unexpected exception
58	Address line 20 test
5A	Keyboard ready test
5C	Determine AT or XT keyboard
5E	Start third protected mode test
60	Base memory test
62	Base memory address test
64	Shadow memory test
66	Extended memory test
68	Extended address test
6A	Determine memory size
6C	Display error messages
6E	Copy BIOS to shadow memory
70	8254 clock test
72	MC146818 real time clock test
74	Keyboard stuck key test
76	Initialize hardware interrupt vectors
78	Math co-processor test
7A	Determine COM ports available
7C	Determine LPT ports available
7E	Initialize BIOS data area
80	Determine floppy/fixed controller
82	Floppy disk test
84	Fixed disk test
86	External ROM scan
88	System key lock test
8A	Wait for F1 key pressed
8C	Final system initialization
8E	Interrupt 19 boot loader
B0	Unexpected interrupt

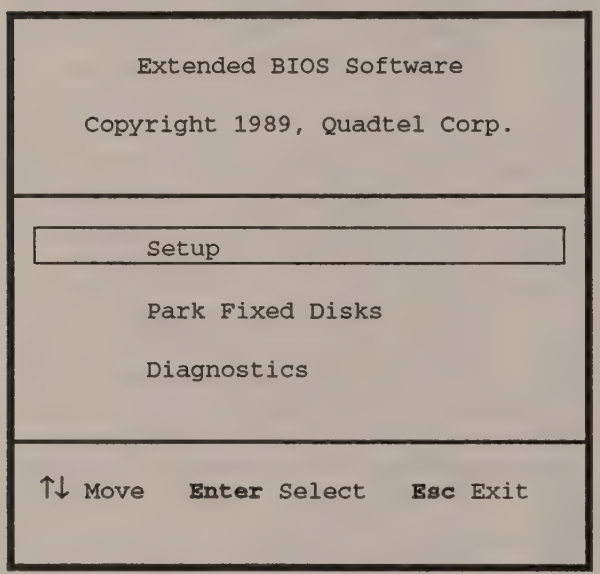
If error 1C, 1E or 20 (base 64K RAM error) is detected by the BIOS, an additional word of information will be displayed to the screen and to port 80. This word will reflect the bit or address line which failed. For example, if "1C 0002" is displayed, address line 1 (represented by bit one) has failed. If "20 1020" is displayed, then data bits 12 and 5 have failed in the upper 16 bits.

The same information will be output to port 80H. The checkpoint code will be output followed by a delay, the high order byte, another delay, and then the low order byte of the error. This will be repeated continuously.

6.9 EXTENDED BIOS DIAGNOSTICS FACILITY

The Extended BIOS Software System is a collection of utility programs which work in conjunction with the system BIOS to provide additional functionality. Included is a set of diagnostic programs for all major system functions. The diagnostics may be run individually or in combination, and they may be set to continue until stopped or until an error occurs.

To display the Extended BIOS Software main window, press <Ctrl><Alt><S>. The system should only be activated when all information in the computer is properly saved as rebooting will occur on exit. The following window will be displayed:



The main menu above will also be displayed if F2 is pressed after a POST error is displayed. To select a function, use the arrow or <tab> keys to highlight it, and then press <enter>.

PARK FIXED DISKS

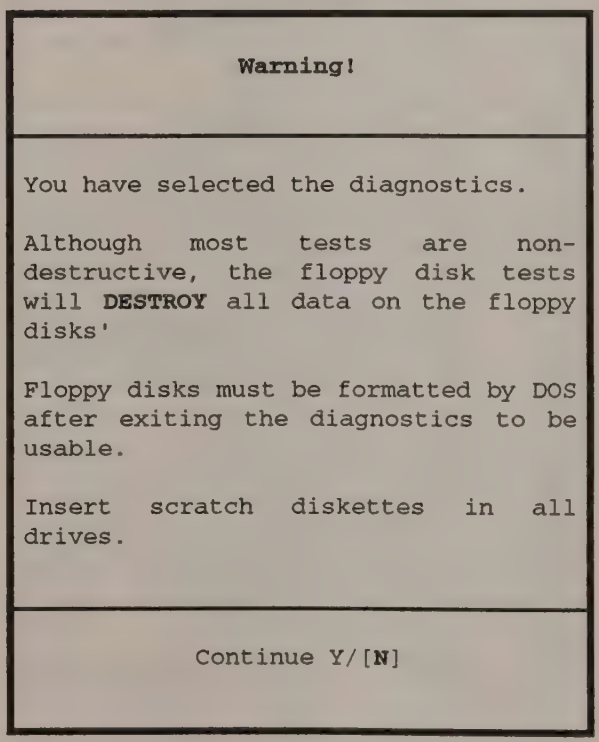
The Park Fixed Disk function will prepare fixed disks for relocation. The fixed disk heads will be placed over a park cylinder to prevent vibrations from causing damage to the media. Most modern disk drives automatically park their heads when power is removed, so the use of this function is usually not necessary.

SETUP

The setup function is explained in detail in the Setup section.

DIAGNOSTICS

If the Extended Diagnostics program is selected, the following screen will appear:


Warning!
You have selected the diagnostics.
Although most tests are non-destructive, the floppy disk tests will DESTROY all data on the floppy disks'
Floppy disks must be formatted by DOS after exiting the diagnostics to be usable.
Insert scratch diskettes in all drives.
Continue Y/[N]

As this is the only warning for the floppy disk test, you should remove any important floppies from the system at this time and then press <Y> to continue. This will cause the main diagnostics window to be displayed as indicated below:

```
          AT ROM Diagnostics V3.04  Copyright 1989 Quadtel Corp.

Continuous: [No ]      Stop on error: [Yes]      Echo log to LPT1: [No ]

     [P] System Board                [N] Monochrome Parallel
   [101] Keyboard Controller         [P] Primary Parallel
[  640K] System Memory               [N] Secondary Parallel
[ 3328K] Extended Memory             [P] Primary Serial
[1.44 M] Diskette Drive 0            [P] Secondary Serial
[ None] EMS Memory
     [P] Fixed Disk 0
     [P] Fixed Disk 1

↑↓  Move       F5  Previous Value      F9  Test Present Devices
F1  Help       F6  Next Value          F10 Test Selected Device Configuration
Esc Exit
```

The middle section of the screen lists and allows selection of the hardware item to be tested and the configuration of that item. Some items are denoted as present (P) or not present (N), while others show information that specifies a hardware type selection. For example, Keyboard can be an 84 key keyboard, a 101 key keyboard, or not present (N). The diskette types are defined as they would be in setup.

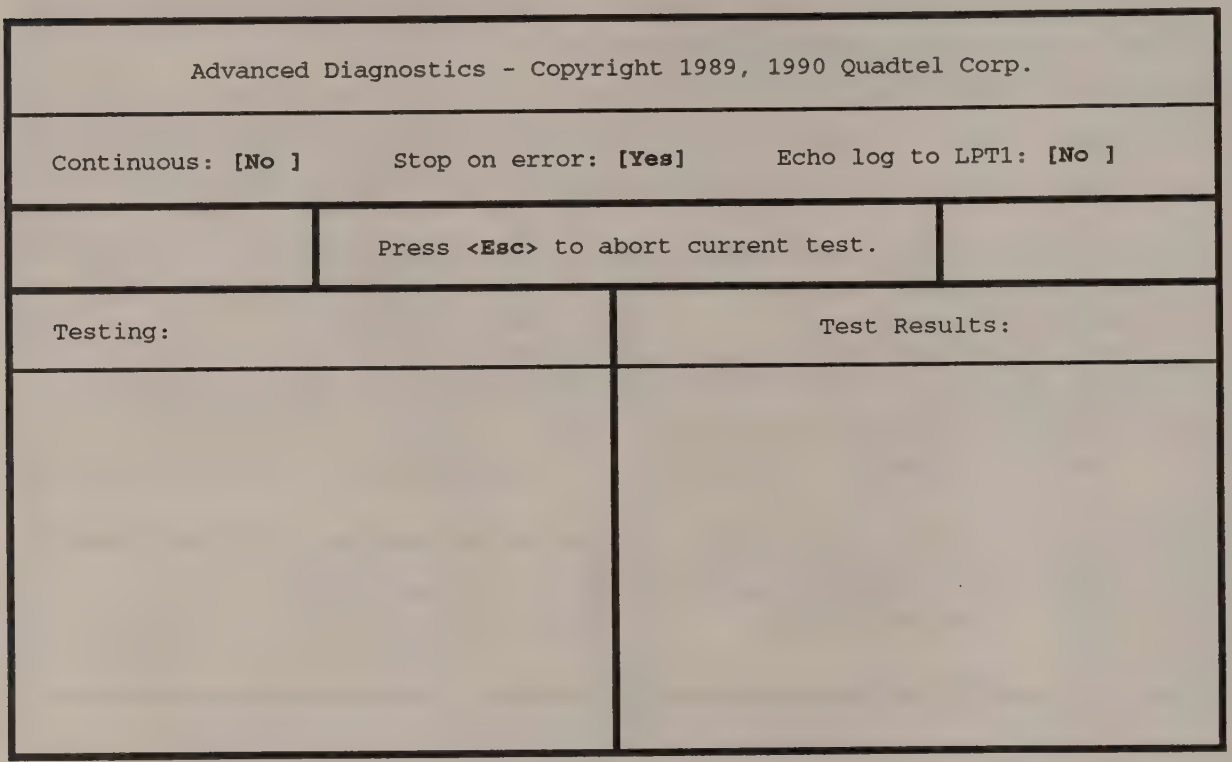
On entry into the diagnostics window, the selections for each test will reflect the hardware which the diagnostic facility has determined is present in the system. A manual selection process can be used to override this automatic selection or to exclude specific tests to be performed rather than an entire suite.

The arrow keys are used to select an item to be tested or changed, and the F5 and F6 keys are used to select new items in each field.

A single item can be tested by moving the cursor to the particular test and pressing the F10 key. The test selection must be set to something other than not- present (N) or None.

Pressing the F9 key will test all of the devices which are currently selected. If there are specific tests which you do not want to be performed, set those test selections to not present (N).

When a single test or a suite of tests is initiated, the following window will be displayed:


Advanced Diagnostics - Copyright 1989, 1990 Quadtel Corp.
Continuous: [No]
Stop on error: [Yes]
Echo log to LPT1: [No]
Press <Esc> to abort current test.
Testing:
Test Results:

The left side of the screen contains information relating to the test currently being performed. The right side of the screen lists the results as tests are completed.

Test Control Options

The fields at the top of the screen represent options which control how the tests are performed, and must be set as desired before tests are initiated.

The Continuous Test field is used to cause tests to be performed continuously until you stop them by pressing <Esc>. When <Esc> is pressed, you can continue again by pressing <Space Bar> or abort the suite of tests by pressing <Esc> again. If a single test is selected using F10, the single test will be repeated if the continuous test field is set to Yes. If a suite of tests is selected using F9, the entire suite will be repeated.

If an error is detected during a suite of tests, the diagnostic system will stop after the error is reported depending on the status of the Stop On Error field of the test control options box.

If the Stop on Error field is set to Yes (the default), the system will report the error and then stop testing until <Space Bar> is pressed to continue or <Esc> is pressed to end testing.

The Echo To LPT1 field will allow you to write the test result data to a printer attached to LPT1. The information written to the right side of the window above will be echoed to LPT1 if this option is set to Yes. This is useful if you set the Continuous Test field to Yes, the Stop On Error field to No, and want to run a test or suite of tests unattended.

Serial Loopback Pinouts

The serial communications tests will detect that a serial loopback connector has been installed and test using it. The pinout of the loopback connector is provided below:

Serial Loopback Connections

DB9 Pin	Signal
1-7-8	CD-RTS-CTS
2-3	TX-RX
4-6	DTR-DSR

Diagnostic Error Codes

When an error is detected by the diagnostics system, a two byte hex code will be displayed, as listed below. The first byte of this code is the class of the error and the second byte the sub-class. The error code class generally corresponds to a specific hardware system or group of hardware systems. For example, class number one (01) is used for the CPU circuit board. The last byte of the code (sub-class), describes the specific test which failed. For example, error code 0108 indicates that the 8253 counter failed during the CPU board test.

Error Codes

CODE	CLASS	FAILURE DESCRIPTION
0101	System Board	DMA registers
0102	System Board	DMA memory move
0103	System Board	Interrupt mask
0104	System Board	Hot interrupt line
0105	System Board	Stuck NMI
0106	System Board	Processor registers
0107	System Board	System timer
0108	System Board	8253 timers
0109	System Board	System timer interrupts (1)
010A	System Board	System timer interrupts (2)
010B	System Board	Processor flags
0110	System Board	CMOS memory
0111	System Board	Real time clock
0120	System Board	BIOS checksum
0701	Keyboard	Controller
0702	Keyboard	Keyboard map
1001	Co-processor	Registers
1002	Co-processor	Calculations
1701	Video	Text Attributes
1702	Video	Background colors
1703	Video	Character set
1704	Video	Text page registration
1705	Video	Text pages
1706	Video	Graphics display
1707	Video	EGA/VGA palette
1708	Video	Memory
1709	Video	VGA sequencer
170A	Video	VGA controller registers
170B	Video	VGA attribute controller
170C	Video	VGA DAC
1730	Video	Cannot initialize video
2001	Serial	Baud rate clock
2002	Serial	Internal loopback data
2003	Serial	Internal loopback control
2004	Serial	External loopback data
2701	LPT	Registers read/write
2702	LPT	Control loopback
2703	LPT	Printed pattern
2704	LPT	Printer not ready
2705	LPT	Unknown error
2706	LPT	No paper / paper jam
2707	LPT	Printer time-out
2708	LPT	Printer busy
3001	Memory	Address lines
3002	Memory	Data patterns
3003	Memory	Walking bits
3701	Disk	Invalid parameter
3702	Disk	Address mark not found
3703	Disk	Write protect error
3704	Disk	Sector not found
3705	Disk	Reset failed
3706	Disk	Change line active
3707	Disk	Drive parameter error
3708	Disk	DMA overrun
3709	Disk	Attempt to DMA across 64K
370A	Disk	Bad sector flag found
370B	Disk	Bad cylinder detected
370C	Disk	Media type not found
370D	Disk	Invalid format sectors count
370E	Disk	Control data mark detected
3710	Disk	CRC or ECC error detected
3711	Disk	ECC corrected error
3720	Disk	General controller failure
3740	Disk	Seek operation
3750	Disk	Change line test
3780	Disk	Drive not ready
37BB	Disk	Undefined error occurred
37CC	Disk	Write fault on selected drive
37E0	Disk	Status error
37FF	Disk	Sense operation failed

Additional Diagnostic Information

The fixed disk tests contained in the Extended BIOS Diagnostic system are all non-destructive except on the diagnostic cylinder. They perform seek tests, head tests and controller tests, but do not perform read/write tests on the entire media.

6.10 MODULE REMOVAL and REPLACEMENT

To gain access to internal assemblies, the cover must first be removed as illustrated in figure 6.1. To accomplish this, first remove the five screws at the rear of the cover and then lift the cover up at the rear and off the unit.

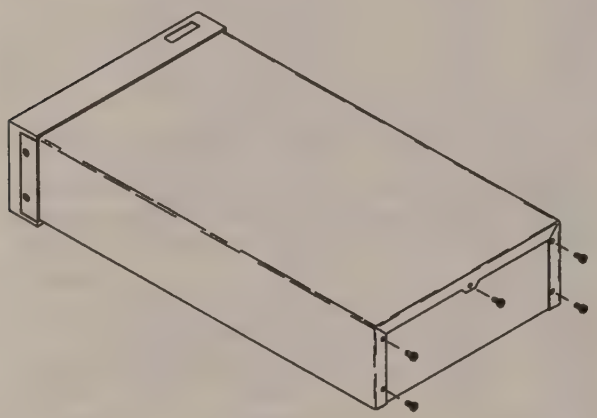


Figure 6.1 - Cover Removal

Figures 6.2 and 6.3 illustrate the removal of the various subassemblies in the computer. Removal of each is explained in the following section. To replace an assembly, reverse the removal process.

> ***DANGER:*** *Remove the power cord from the unit before performing service procedures.*

> ***CAUTION:*** *Electronic devices are susceptible to damage from static discharges built up on the human body by motion. Use an anti-static wrist strap and ground wire when performing the following procedures.*

FIXED DISK DRIVE REMOVAL

Refer to figure 6.2.

1. Unplug the two cables, signal and power, from the fixed disk drive (3).

2. Remove the two 6-32 X 1/4" Phillips flathead screws (1) and two 4-40 x 1/4" Phillips flathead screws (4).

3. Lift out the fixed disk drive assembly (2,3) by moving it rearward, lifting the front edge upward until clear, and then lifting out the assembly.

4. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

BACKPLANE REMOVAL

Refer to figure 6.2.

1. Remove any installed card options by reversing the installation procedure described in the installation section.

2. Unplug the cables attached to the backplane (8).

3. Remove the four 4-40 x 1/4" Phillips flathead screws (9).

4. Lift the backplane assembly (8) upward, being careful not to damage the small bead thermistor at the end of the assembly closest to the rear of the computer chassis. As the unit is lifted out, the cables leading to the front panel must be threaded out from between the backplane circuit board and the bracket along its top edge.

5. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

POWER SUPPLY REMOVAL

Refer to figure 6.2.

1. Remove the fixed disk drive assembly (2,3) as explained previously.

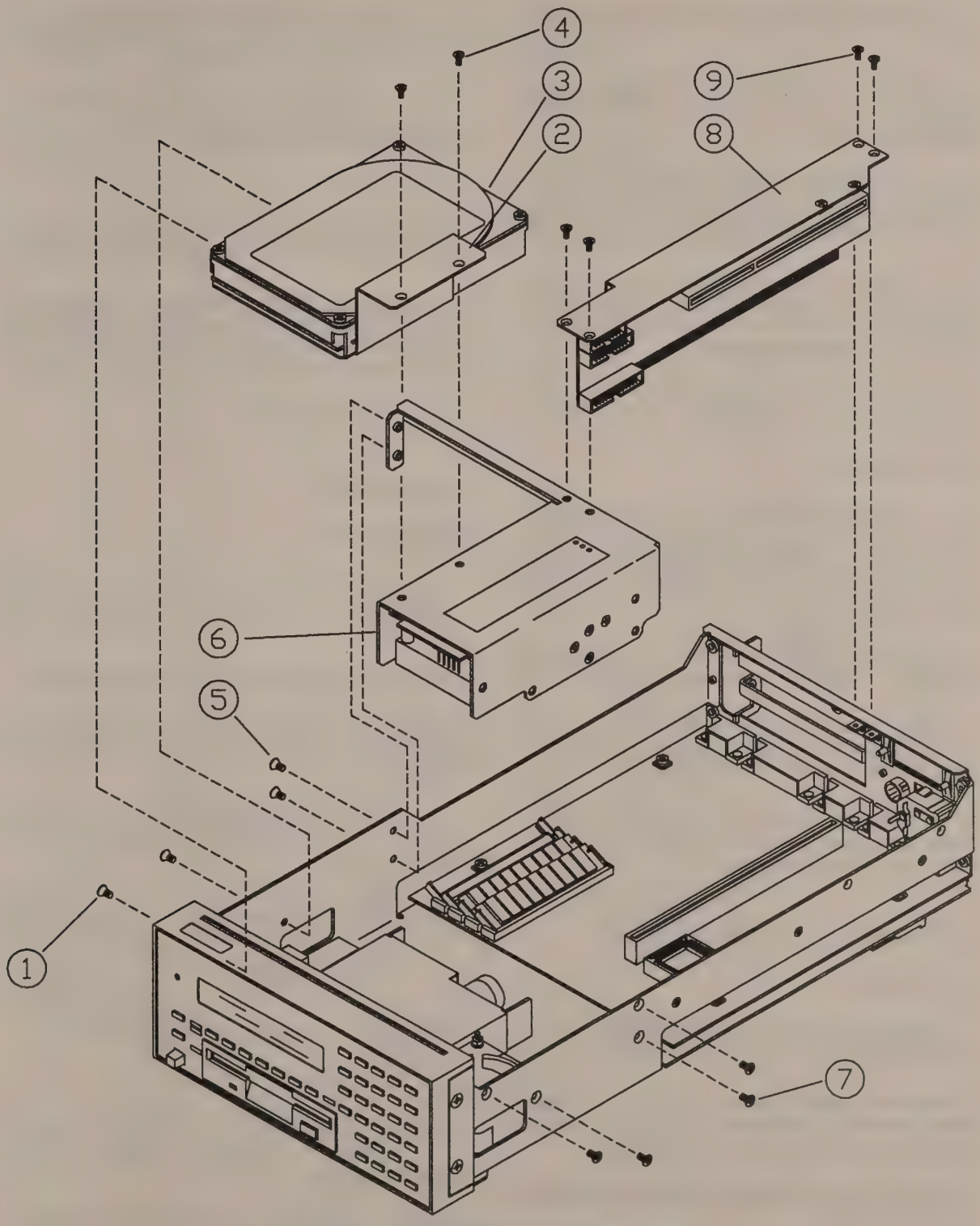


Figure 6.2 - 8440A-8443A Upper Assemblies

2. Unplug the DC power cable from the CPU circuit board.

3. Remove the six 6-32 x 1/4" Phillips flathead screws (7 and 5) from the sides of the computer chassis.

4. Move the power supply assembly (6) slightly rearward and tilt the front edge upward. Unplug the AC power cable from the front of the supply and lift it free.

5. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

FRONT PANEL REMOVAL

Refer to figure 6.3.

1. Remove the front feet (3) and bails (4) form the computer chassis (24) by loosening the screws inside the feet. Remove the four 8-32 X 1/4" Phillips flathead screws (6) from and remove the side cover plates (5).

2. Remove the three 6-32 x 5/16" screws (1) from the bottom of the front panel assembly (2).

3. Begin to remove the assembly by tilting the bottom edge forward and upward, unplugging the cables in the process. Lift the panel free.

4. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

DISKETTE DRIVE REMOVAL

Refer to figure 6.3.

1. Unplug the two cables, signal and power, from the rear of the diskette drive (18).

2. Remove the four flathead screws (17). The size of these screws is dependent on the drive used. Be careful to retain the screws for reinstallation.

3. Slide the diskette drive out through the front panel of the computer.

4. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

REAR PANEL REMOVAL

Refer to figure 6.3.

1. Disconnect the two AC power leads from the power receptacle on the rear panel assembly (14).

2. Remove the eight 4-40 jackscrews (15) and the two 4-40 x 1/4" Phillips flathead screws (16) from the rear of the unit. Remove the three 6-32 x 1/4" Phillips flathead screws from the bottom of the unit.

3. Remove the assembly.

FAN REMOVAL

Refer to figure 6.3.

1. Remove the fixed disk and power supply assemblies (2, 3, and 6 in figure 6.2) as described previously.

2. Unplug the fan cable from the front panel board.

3. Remove the four 6-32 nylon insert nuts (12), four #6 split lockwashers (11) and four #6 flatwashers (10).

4. Lift out the fan assembly. The four #6 flatwashers (8) and fan grill screen (7) can be removed or left in place as desired.

5. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

CPU CIRCUIT BOARD REMOVAL

Refer to figure 6.3.

1. Remove any installed card options by reversing the installation procedure described in the installation section.

2. Remove the backplane assembly (8 of figure 6.2) as explained previously.

3. Unplug the DC power cable coming from the power supply.

4. Remove the eight 4-40 jackscrews (15) from the rear of the unit, and the four 6-32 x 3/8" screws (27), four #6 split lockwashers (26), and four #6 flatwashers (25).

5. Slide out the CPU circuit board assembly (23) through the slot in the left side of the computer chassis (24).

6. To protect the assembly from damage due to static discharge, enclose it in an anti-static bag or aluminum foil wrap until needed.

POWER SWITCH CIRCUIT BOARD REMOVAL

Refer to figure 6.3.

1. Remove the fixed disk assembly (2, 3 in figure 6.2) as described previously.

2. Unplug the AC power cable from the power switch circuit board assembly (19).

3. Remove the two 6-32 x 3/8" screws (22), two #6 split lockwashers (21), and two #6 flatwashers (20).

4. Move the assembly rearward until the power switch actuator button is clear of the front panel assembly and then out of the unit.

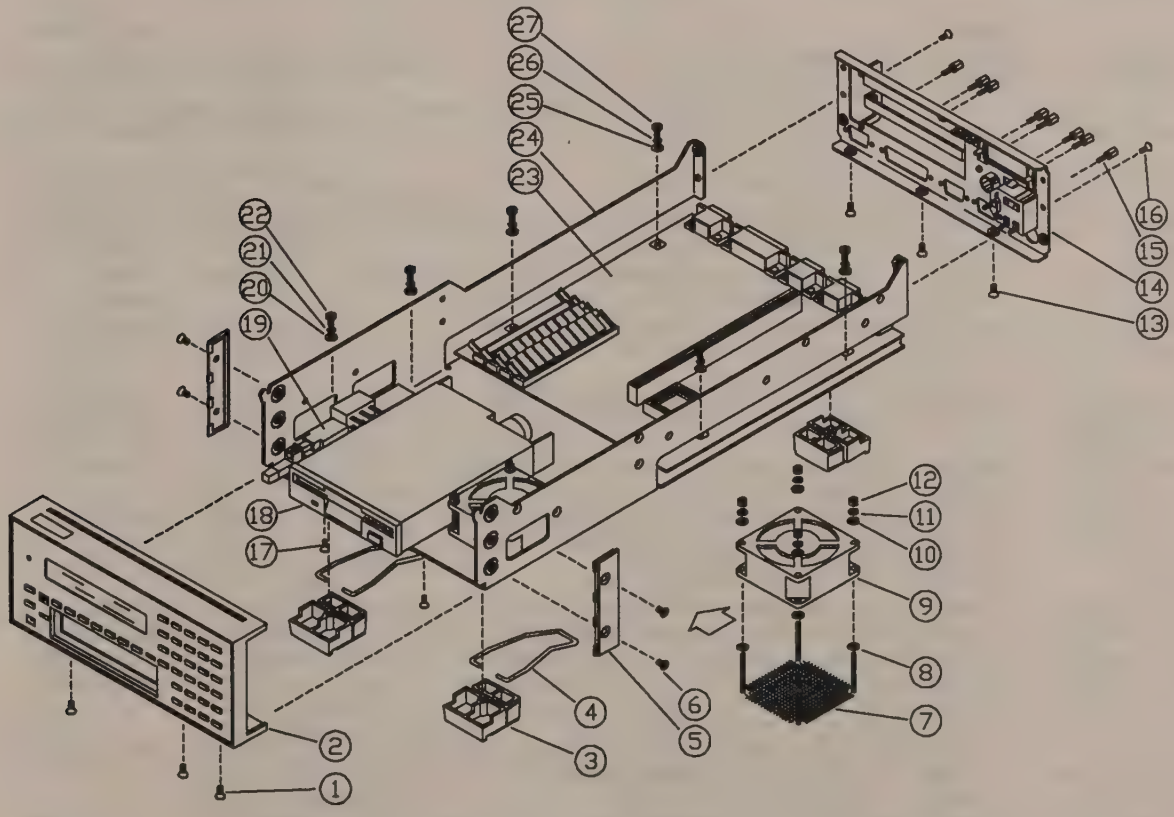


Figure 6.3 - 8440A-8443A Lower Assemblies

CIRCUIT BOARD ASSEMBLY, FRONT PANEL - 60-844001

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
A101	104-0012	RESISTOR,5%,1/4W,CF,3 OHM	1	ROHM	
D104,105,107-109	132-0401	LED,AMBER,HP,HLMP-0401	5	LUMEX	SSL-LX25783YD
D105	208-2002	INSULATOR, TUBING, HEAT SHRINK, POLYOLEFIN, 1/4"	0	STORM	208-2002
J101	10-003208	CONN,HEADER,2 X 8,4 WALL,MALE,VT PC MNT	1	MOLEX	39-28-5161
J102	10-003210	CONN,HEADER,2 X 10,4 WALL,MALE,VT PC MNT	1	MOLEX	39-28-5201
J103(1 to 3,4 to 6)	23-400028	W,28 AWG,BUSS	1	STORM	NONE
J105	304-0351	CONNECT,SGL ROW,3PIN,PC MT,HDR,ST.PIN,.1LS	1	MOLEX	22-03-2031
PCB	40-844001	PCB,FRONT PANEL,INSTRUMENT COMPUTER	1	MAXUS	40-844001
R101	18-023133	R,330 OHM,.625W,2%,NET,SIP,COMMON,6 PIN	1	CTS	770-61-R-331
R102	18-061310	R,10K,.5W,10%,POT,S-T,TOP ADJ,VT PC MNT	1	BOURNS	3329H-103
S101-110,113-139	19-040001	S,PUSHBUTTON,MOM,8MM,PC MNT	37	PANASONIC	EVQ-QJJ05Q

CIRCUIT BOARD ASSEMBLY, BACKPLANE - 60-844002

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
C1-4,7,8,10,13,16	122-4100	C,.047uf,50V,+ /-20%,CER,.1" RADIAL,NPO	9	MALLORY	0C331K1G5CA
C5,6,11,14,17	126-1676	C,22uf,10V,+/-20%,TNT,.1"LS	5	SPRAGUE	199D226X0010CA1
C9,12,15	126-1452	C,10uf,25V,+/-20%,TNT,.1"LS	3	KEMET	T350E106M025AS
D1	131-4002	DIODE, RECTIFIER, 1N4002	1	MOTOROLA	1N4002
D2	141-0336	IC, ANALOG, VOLT REG, REF, LM336Z-2.5V	1	NATIONAL	LM336Z-2.5V
D3	131-4148	DIODE, SMALL SIGNAL, 1N4148	1	MOTOROLA	1N4148
J1,3	10-003210	CONN,HEADER,2 X 10,4 WALL,MALE,VT PC MNT	2	MOLEX	39-28-5201
J2	10-003208	CONN,HEADER,2 X 8,4 WALL,MALE,VT PC MNT	1	MOLEX	39-28-5161
J4	304-0351	CONNECT,SGL ROW,3PIN,PC MT,HDR,ST.PIN,.1LS	1	MOLEX	22-03-2031
J5,6,7	10-003213	CONN,HEADER,2 X 13,4 WALL,MALE,VT PC MNT	1	MOLEX	39-28-5261
J8/9,10/11,14/15	10-630001	CONN,CARD EDGE,2 X 31/2 X 18,PC MNT	3	HOLMBERG	C8D52DS29C1M191
PCB	40-844002	PCB,BACKPLANE,INSTRUMENT COMPUTER	1	MAXUS	40-844002
Q1	133-0120	TRANSISTOR,PNP,TIP120	1	SGS	TIP120
Q2	133-3906	TRANSISTOR,SM SIGNAL,BIPOLAR,PNP,2N3906	1	MOTOROLA	2N3906
R1,2	114-1625	R,10K,1.125W,2%,NET,SIP,COMMON,10 PIN	2	AB	710A103
R10	102-0300	RESISTOR,1%,1/8W,MF,13K	1	ROHM	
R12	104-0025	RESISTOR, CF, 1/4W, 5%, 10 OHM	1	ROHM	
R13	18-080001	R,10K,10%,NTC,THERMISTOR	1	KEYSTONE	KC018N
R14	114-1425	R,4.7K,.625W,2%,NET,SIP,COMMON,6 PIN	1	BOURNS	4606X-101-472
R15	102-0273	RESISTOR, MF, 1/8W, 1%, 6.81K, RN55D	1	ROHM	6811FRN55D
R16	102-0289	RESISTOR, MF, 1/8W, 1%, 10.0K, RN55D	1	ROHM	1002FRN55D
R17	102-0427	RESISTOR,274K,1%,1/8W,MF	1	ROHM	
R18	104-0065	RESISTOR, CF, 1/4W, 5%, 470 OHM	1	ROHM	
R3	18-023147	R,470 OHM,.625W,2%,NET,SIP,COMMON,6 PIN	1	CTS	770-61-R471
R4	104-0057	RESISTOR,CF,5%,1/4W,220 OHMS	1	ROHM	
R5	104-0081	RESISTOR, CF, 1/4W, 5%, 2.2K	1	ROHM	
R6,8	104-0073	RESISTOR, CF, 1/4W, 5%, 1.0K	2	ROHM	
R7	104-0097	RESISTOR, CF, 1/4W, 5%, 10K	1	ROHM	
R9	102-0312	RESISTOR,MF,1%,1/8W,RN55D,17.4K	1	ROHM	
S1	19-030001	S,SLIDE,SPST,4A,9 POS,DIP PC MNT	1	GRAYHILL	78B09
U1	160-0074	IC, DIGITAL, TTL, 74LS74	1	MOTOROLA	SN74LS74AN

U10	21-050339	IC,CMPRTR,QUAD,LM339,DIP-14,PLASTIC	1	MOTOROLA	LM339N
U11	145-0393	IC,LM393NE	1	NATIONAL	LM393NE
U2	21-072001	IC,PAL,AND-OR/22V10,DIP-24,PLASTIC	1	CYPRESS	PALC22V10-25C
U2,8	307-2451	CONN,IC SOCKET,ICE-243-S-TG30	2	RN	ICE-243-S-TG30
U3	21-011174	IC,HEX D F-F,74LS174,DIP-16,PLASTIC	1	MOTOROLA	74LS174
U4	160-0682	IC,TTL,SN74LS682N	1	MOTOROLA	SN74LS682N
U5	141-7905	IC,LM7905CT	1	MOTOROLA	MC7905CT
U6	160-0245	IC, DIGITAL, TTL, 74LS245	1	MOTOROLA	SN74LS245N
U7	160-0244	IC, DIGITAL, TTL, 74LS244	1	MOTOROLA	SN74LS244N
U8	21-072002	IC,PAL,ACTIVE LOW/20L8,DIP-24,PLASTIC	1	TI	TIBPAL20L815C NT
U9	160-0014	IC,SN74LS14AN	1	MOTOROLA	SN74LS14N

CIRCUIT BOARD ASSEMBLY, POWER SWITCH - 60-844003

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
J301	10-080408	CONN,HEADER,1 X 8,.156 CTR,MALE,RT PC MNT	1	MOLEX	26-60-3080
PCB	40-844003	PCB,POWER SWITCH,INSTRUMENT COMPUTER	1	MAXUS	40-844003
S301	320-NE15	S,PB,ALT/ACTION,DPDT,6A/250VAC,PC/RT MNT	1	SCHADOW	NE1800E0042P
S301	53-220005	MOLDING,PLASTIC,POWER SWITCH BUTTON	1	UNIVERSAL	53-220005
S302	320-0802	SWITCH,110/220,C&K,V802-12-MA-08-Q	1	C&K	V802-12-MA-08-Q

CIRCUIT BOARD ASSEMBLY, POWER SUPPLY - 60-844004

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
C1-3,5,18,19	122-4100	C,.047uf,50V,+ /-20%,CER,.1" RADIAL,NPO	6	MALLORY	320C331K1G5CA
C12	122-2525	C,300pf,100V,+/-10%,CER,.1" RADIAL,COG	1	KEMET	C32OE331K165CA
C13-16	125-3378	CAP,ALUM,RADIAL,LOW ESR,20%,10V,4700UF	4	PANASONIC	ECE-A1HGE471
C20,21	126-1452	C,10uf,25V,+/-20%,TNT,.1"LS	2	KEMET	T350E106M025AS
C4	125-3525	CAP,6800UF,RADIAL,25V,ALUM	1	PANASONIC	ECES1EU682G
C6-9	125-2653	CAP,470UF,RADIAL,50V,ALUM	4	PANASONIC	ECE-A1AF5472
D1,3	131-0402	DIODE,D-BRIDGE,RS402L	2	D.I.	RS402L
D2	131-1604	DIODE,40V,16AMP,DUAL SCHOTKEY	1	D.I.	SR1604C
D5-7	132-1790	LED,GREEN,HP,HLMP-1790	3	HP	HLMP-1790
D8-10	131-4002	DIODE, RECTIFIER, 1N4002	3	MOTOROLA	1N4002
J1	304-0551	J, 1 X 5, PC MT,HDR,POL, WAFER,.156L	1	MOLEX	09-60-1051
J4(2-3),J5(1-2,4-5)	23-400028	W,28 AWG,BUSS	2	STORM	
L1-3	173-0002	FERRITE BEAD, LARGE, 2673000801	3	FAIR-RITE	2673000801
L4	170-5150	INDUCTOR,POWER,PULSE ENG,PE-51509	1	PULSE	PE-51509
PCB	40-191001	PCB,UTILITY POWER SUPPLY	1	MAXUS	40-191001
Q1	136-0045	TRANSISTOR,PNP,10A,60V,D45H8	1	HARRIS	D45H8
R1	103-0049	RESISTOR,METAL OXIDE,2W,100 OHM	1	YAGEO	MO-2W-B-100
R2	23-400014	W,14 AWG,BUSS	1	STORM	
R3	104-0033	RESISTOR,CF,5%,1/4W,22 OHM	1	ROHM	
R4	120-0175	R,500 OHM,.5W,10%,POT,S-T,TOP ADJ,VT PC MNT,.250"	1	BOURNS	3329H-1-501
R5	102-0193	RESISTOR, MF, 1/8W, 1%, 1.00K, RN55D	1	DALE	1001FRN55D
R6	102-0248	RESISTOR,1%,1/4W,RN55D,3.74K	1	DALE	
R7	110-1025	R,1K,.625W,2%,NET,SIP,COMMON,6 PIN	1	BOURNS	4606X-101-102
T1	171-0716	TRANSFORMER,SIGNAL,DST-7-16	1	SIGNAL	DST-7-16
U1	161-3406	IC,CMOS,SIGNAL REG CNTRLLR,MC34063,TI	1	TI	MC34063TI
U1	307-0850	J, IC SOCKET,8PIN,PC MT,LOW PROF	1	R/N	ICL083-S6-T
U2	141-7912	IC,REGULATOR,LM7912CT	1	NATIONAL	LM7912CT

U4	141-7812	IC,REGULATOR,LM7812CT	1	NATIONAL	LM7812CT

CIRCUIT BOARD ASSEMBLY, LCD DISPLAY - 61-844001

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	321-0240	WIRE, #24, STRANDED,TINNED COPPER,PVC,BLK	2	STORM	
-	321-0242	WIRE, #24, STRANDED,TINNED COPPER,PVC,RED	2	STORM	B24 7/32-2
-	64-844008	CBA,LCD DISPLAY CABLE,8440A	1	MAXUS	64-844008
-	09-010001	I,2 X 24 LCD W/LED BACKLIGHT	1	STANLEY	GMD2421ASLY

CABLE ASSEMBLY, AC POWER - 64-844001

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	06-020003	F,.500A,250V,SLO-BLO,5 x 20MM	2	LITTLE	218.500
-	208-2001	INS, TUBING, HEAT SHRINK, POLYOLEFIN, 1/8	1	STORM	FP-301-1/8-0
-	23-011180	WIRE,18 AWG,19/30,BLK,UL1015	21	STORM	
-	23-011181	WIRE,18 AWG,19/30,BRN,UL1015	16	STORM	
-	23-011182	WIRE,18 AWG,19/30,RED,UL1015	16	STORM	
-	23-011184	WIRE,18 AWG,19/30,YEL,UL1015	16	STORM	
-	23-011185	WIRE,18 AWG,19/30,GRN,UL1015	18	STORM	
-	23-011189	WIRE,18 AWG,19/30,WHT,UL1015	21	STORM	
-	306-0004	CONNECT,P&S,HDWR,TERM,2478TL/08-50-0106	10	MOLEX	08-50-0106
-	10-081005	J, HOUSING,1 X 5,.156 CTR,SCKT,CRMP,CABLE	1	MOLEX	09-50-3051
-	10-081008	J, HOUSING,1 X 8,.156 CTR,SCKT,CRMP,CABLE	1	MOLEX	09-50-3051
-	170-9933	J, POWER INLET,2200 SERIES	1	PANEL COMP	83110120
-	216-2002	J, SOLDER LUG, #6	1	A & I	

CABLE ASSEMBLY, DC POWER - 64-844002

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	10-081012	J, HOUSING,1 X 12,.156 CTR,SCKT,CRMP,CABLE	1	MOLEX	09-50-3121
-	23-011180	WIRE,18 AWG,19/30,BLK,UL1015	36	STORM	
-	23-011182	WIRE,18 AWG,19/30,RED,UL1015	12	STORM	
-	23-011183	WIRE,18 AWG,19/30,ORG,UL1015	12	STORM	
-	23-011186	WIRE,18 AWG,19/30,BLU,UL1015	12	STORM	
-	306-0004	CONNECT,P&S,HDWR,TERM,2478TL/08-50-0106	6	MOLEX	08-50-0106

CABLE ASSEMBLY, DRIVE POWER - 64-844003

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	10-171101	CONTACT,BERG MINI-PV,22-26 AWG	16	BERG	47712-000
-	10-171230	CONN,2 X 15 HOUSING,.1 CTR,POL,BERG MINI-PV	1	BERG	65846-002
-	208-2001	INS, TUBING, HEAT SHRINK, POLYOLEFIN, 1/8	3	STORM	FP-301-1/8-0
-	10-071004	CONN,HOUSING,1 X 4,.1 CTR,SCKT,CRMP,CABLE	1	MOLEX	22-01-3647
-	306-0003	CONNECT,P&S,HDWR,TERM,2759TL/08-05-0114	4	MOLEX	08-50-0114
-	10-091004	CONN,HOUSING,1 X 4,.2 CTR,SCKT,CRMP,CABLE	1	MOLEX	15-24-4048
-	10-091101	CONTACT,POWER,SCKT,14-20 AWG	4	MOLEX	02-08-1202
-	321-0241	WIRE, #24, STRANDED,TINNED COPPER,PVC,BRN	4	STORM	B24 7/32-1
-	321-0240	WIRE, #24, STRANDED,TINNED COPPER,PVC,BLK	24	STORM	B24 7/32-0
-	321-0243	WIRE, #24, STRANDED,TINNED COPPER,PVC,ORG	12	STORM	B24 7/32-3
-	321-0242	WIRE, #24, STRANDED,TINNED COPPER,PVC,RED	12	STORM	B24 7/32-2

CABLE ASSEMBLY, FRONT PANEL KEYPAD - 64-844004

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	23-020020	CABLE,20 COND,28 AWG,.050 CTR,PVC	15	BELDEN	9L28020
-	10-027010	J, IDC, 2 X 10,SCKT,POL,W/O STR RLF	2	MOLEX	39-52-1205

CABLE ASSEMBLY, FRONT PANEL CONTROLS - 64-844005

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	322-0016	CABLE,RIBBON,16 CONDUCTOR	15	3M	3365/26
-	310-1626	J, IDC, 2 X 8,SCKT,POL,W/O STR RLF	2	RN	IDS-C16PK-TR

CABLE ASSEMBLY, DISKETTE SIGNAL - 64-844006

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	310-3425	CONN,IDC, 2 X 17,SCKT,POL.W/O STR RLF	2	RN	IDS-C34PK-TR
-	322-0034	CABLE,RIBBON,34 CONDUCTOR	13	3M	3365/34

CABLE ASSEMBLY, FIXED DISK SIGNAL - 64-844007

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	10-027020	CONN,IDC, 2 X 20,POL,SCKT,W/O STR RLF	2	MOLEX	39-52-1405
-	23-020040	CABLE,40 COND,28 AWG,.050 CTR,PVC	14	BELDEN	9L28040

CABLE ASSEMBLY, LCD DISPLAY - 64-844008

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	23-020020	CABLE,20 COND,28 AWG,.050 CTR,PVC	14	BELDEN	9L28020
-	10-027010	CONN,IDC, 2 X 10,SCKT,POL,W/O STR RLF	1	MOLEX	39-52-1205
-	10-026207	CONN,IDC, 2 X 7,PCB TRANS,W/O STR RLF	1	RN	IDL-C14-1-T

MECHANICAL ASSEMBLY, FRONT PANEL - 65-844001

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	215-3240	SCREW,PHILLIPS,SS,SELF TAPPING,4/40X1/4	12	ARROWFAST	215-3240
-	39-000007	LABEL	1	PAPILLON	39-000007
-	51-000001	DSP WINDOW,POLYCARB, .050 X 1.00 X 4.00	0	MAXUS	
-	53-220001	MOLDING,FRONT BEZEL,2200/8400 SERIES	1	FARMERS	53-220001
-	53-220006	MOLDING,PLASTIC,INSTRUMENT BUTTON	37	UNIVERSAL	53-220006
-	60-844001	PCA,FRONT PANEL,INSTRUMENT COMPUTER	1	NATLCIRCT	60-844001
-	61-844001	ASSY,LCD PREP,INSTRUMENT COMPUTER	1	MAXUS	61-844001

MECHANICAL ASSEMBLY, CHASSIS - 65-844002

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	215-2260	SCREW, PANHEAD,PHILLIPS,SS,4-40 X 3/8	2	A&I	
-	29-110204	WASHER,SPLIT-LOCK,SS,#4	2	A&I	
-	42-844007	SHEET METAL,8440 BACKPLANE BRACKET	1	PRIDE	42-840702
-	60-844002	PCA,BACKPLANE,INSTRUMENT COMPUTER	1	MAXUS	60-844002
-	64-844003	CBA.DISK POWER/CPU CABLE,8440A	1	MAXUS	64-844003
-	64-844004	CBA,KEYBOARD CABLE,8440A	1	MAXUS	64-844004
-	64-844005	CBA,FRONT PANEL CABLE,8440A	1	MAXUS	64-844005
-	208-2004	INSULATOR, MYLAR,4671K-ND,DIGIKEY	2	KEYSTONE	4671
-	214-0100	NUT, HEX, NYLON INSERT, 4-40	2	A&I	
-	216-4002	WSR, NYLON SHOULDER,4/40	2	SEASTROM	5607-150
-	29-090408	SCREW,4-40 X .250,UNDERCUT,PFH	2	A&I	

MECHANICAL ASSEMBLY, POWER SUPPLY - 65-844004

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	215-2263	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 3/8	2	A&I	
-	216-0006	WASHER,FLAT,SS,#6	4	A&I	
-	29-000652	SCREW,6-32 X 1.625,PPH	4	A&I	
-	29-110206	WASHER,SPLIT-LOCK,SS,#6	6	A&I	
-	31-100001	CLAMP,CABLE,BLK,PLASTIC	2	RICHCO	TC-30-1
-	39-000006	LABEL,POWER SUPPLY CAUTION	1	PAPILLON	39-000006
-	42-844004	FRAME, 8440 POWER SUPPLY	1	PRIDE	42-844004
-	60-844004	PCA,POWER SUPPLY,INSTRUMENT COMPUTER	1	MAXUS	60-844004
-	64-844002	CBA,DC POWER CABLE,8440A	1	MAXUS	64-844002
-	215-2243	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 1/4	2	A&I	
-	208-2004	INSULATOR,MYLAR,4671K-ND,DIGIKEY	4	KEYSTONE	4671
-	214-0100	NUT, HEX, NYLON INSERT, 4-40	4	A&I	
-	216-4002	WSR,NYLON SHOULDER,4/40	4	SEASTROM	5607-150
-	29-090408	SCREW,4-40 X .250,UNDERCUT,PFH	4	A&I	

MECHANICAL ASSEMBLY, REAR PANEL - 65-844020

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	30-200001	BRACKET,MOUNTING,RT ANGLE,4-40/.203,STEEL	2	KEYSTONE	612
-	42-844003	SHEET METAL,8440/8441 REAR PANEL	1	PRIDE	42-844003
-	42-844005	SHEET METAL,8440/8441 CONNECTOR BRACKET	1	PRIDE	42-844005
-	64-844001	CBA,AC POWER CABLE,8440A	1	MAXUS	64-844001
-	215-2240	SCREW, PANHEAD,PHILLIPS,SS,4-40 X 1/4	2	A&I	
-	29-110204	WASHER, SPLIT-LOCK,SS,#4	2	A&I	
-	215-1040	SCREW, FLATHEAD,PHILLIPS,SS,4-40 X 1/4	1	A&I	
-	30-400003	COVER,CONNECTOR,2.17" X .68",BLK PLASTIC	1	BIVAR	12-24R
-	29-300408	RIVET,POP,.125D X .250L	1	A&I	
-	30-400001	PLUG,HOLE,.500D,BLK PLASTIC	1	KEYSTONE	8603

MECHANICAL ASSEMBLY, FINAL - 66-844001

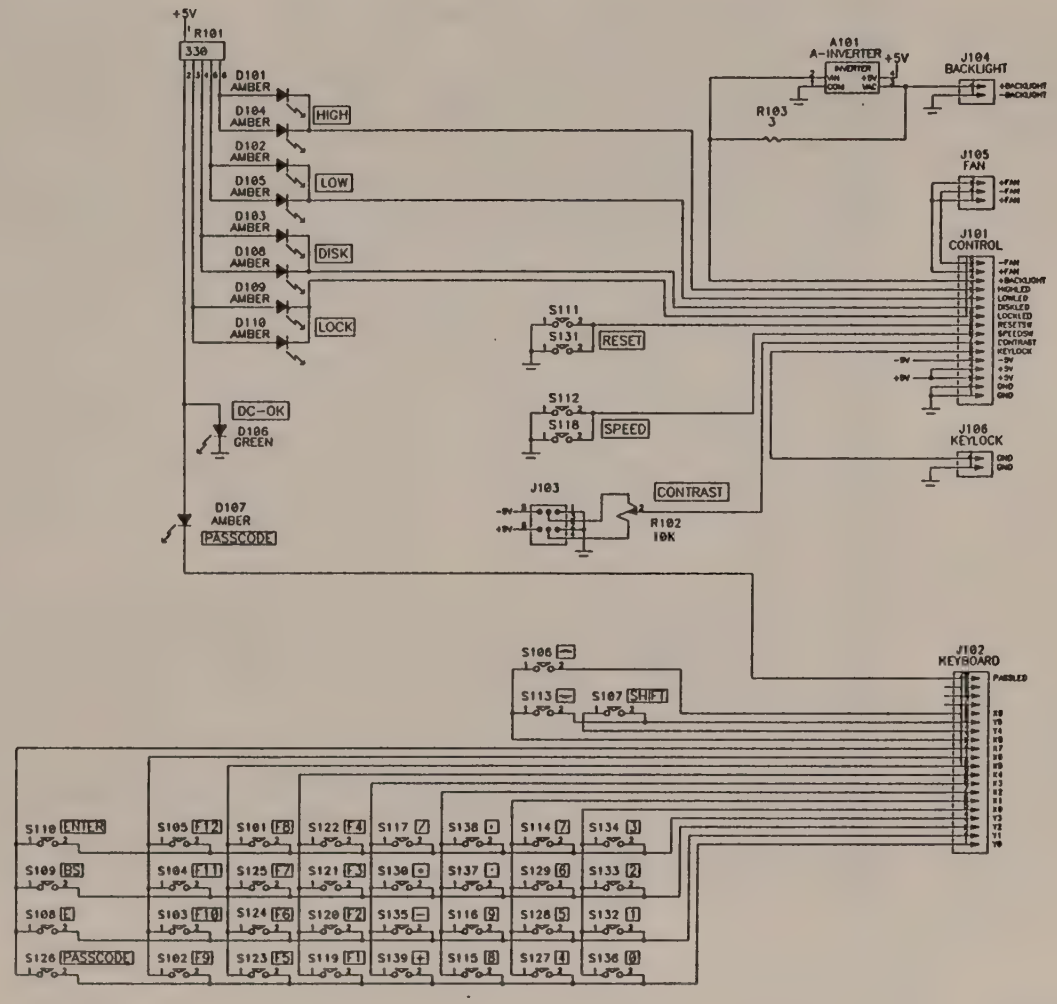
Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	301-0001	CONNECT,D,HDWR,STDOFF RECEPT KIT,MD000T2	8	POSITRONIC	MD000T2
-	01-844002	DRIVE,HARD DISK,120MB,3.5"	1	MAXTOR	7120AT
-	01-844003	DRIVE,FLOPPY DISK,1.44MB,3.5"	1	TEAC	FD235HF
-	01-844004	CPU,386-25MHZ,512 VIDEO RAM	1	DOVER	D3512-25
-	01-844005	SIMM,256K X 9,80ns	4	TOSHIBA	
-	11-100001	FAN,12VDC,BRUSHLESS,60 X 23MM	1	SEIWA	SDF-60/12H
-	42-844001	CHASSIS,INST. COMPUTER,8440/8441	1	PRIDE	42-844001
-	42-844006	SHEET METAL,8440 DISK DRIVE BRACKET	1	PRIDE	42-844006
-	60-844003	PCA,POWER SWITCH,INSTRUMENT COMPUTER	1	NATL	60-844003
-	64-844006	CBA,FLOPPY DATA CABLE,8440A	1	MAXUS	64-844006
-	64-844007	CBA,HARD DISK DATA CABLE,8440A	1	MAXUS	64-844007
-	65-844001	ASSY, FRT PNL W/BACKLIGHT,INST. COMPUTER	1	MAXUS	65-844001
-	65-844002	ASSY,BACKPLANE,8440	1	MAXUS	65-844002
-	65-844004	ASSY,POWER SUPPLY,8440	1	MAXUS	65-844004
-	65-844020	ASSY,REAR PANEL,INSTRUMENT COMPUTER	1	MAXUS	65-844020
-	211-0001	CABLE TIES, NYLON, PLC1M-S4-M,PANDUIT	6	PANDUIT	LC1M-S4-M
-	214-0100	NUT, HEX, NYLON INSERT, 4-40	6	A&I	
-	215-1060	SCREW, FLATHEAD,PHILLIPS,SS,4-40 X 3/8	3	A&I	
-	215-2263	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 3/8	4	A&I	
-	29-110206	WASHER,SPLIT-LOCK,SS,#6	4	A&I	
-	214-2101	NUT, HEX, NYLON INSERT, 6-32	4	A&I	
-	216-0006	WASHER,FLAT,SS,#6	8	A&I	
-	30-700001	SCREEN,MESH,2.4" X 2.4"	1	A&I	
-	29-045508	SCREW,M3.0 X 8MM,PFH	4	A&I	
-	215-1063	SCREW, FLATHEAD, PHILLIPS, SS, 6-32 X 3/8	3	A&I	
-	215-2253	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 5/16	2	A&I	
-	215-1040	SCREW, FLATHEAD,PHILLIPS,SS,4-40 X 1/4	8	A&I	
-	215-1043	SCREW,PHILLIPS,SS,FLATHEAD,6-32 X .250"	11	NONE	NONE

MECHANICAL ASSEMBLY, SHIPPING - 67-844001

Reference	Maxus Part #	Description	Qty	Manufacturer	Manufacturer Part #
-	01-844007	CABLE, KEYBOARD ADAPTOR	1	KRISTA	23-642
-	299-0103	FOOT PAD, 2000/2200 FEET, DENVER GASKET	4	DG	299-0103
-	299-0110	FOOT, BRACKET, HP, 1460-1345	2	H-P	299-0110
-	42-844002	SHEET METAL,8440/8441 COVER	1	PRIDE	42-844002
-	53-220002	MOLDING,PLASTIC,SIDE FILLER PLATE, 2200/8400	2	UNIVERSAL	53-220002
-	53-220003	MOLDING,PLASTIC,CABINET FOOT	4	UNIVERSAL	53-220003
-	66-844001	ASSY,CHASSIS,INSTRUMENT COMPUTER	1	MAXUS	66-844001
-	215-2263	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 3/8	5	A&I	
-	215-2283	SCREW, PANHEAD,PHILLIPS,SS,6-32 X 1/2	4	A&I	
-	215-1046	SCREW, FLATHEAD, PHILLIPS, SS, 8-32 X 1/4	4	A&I	

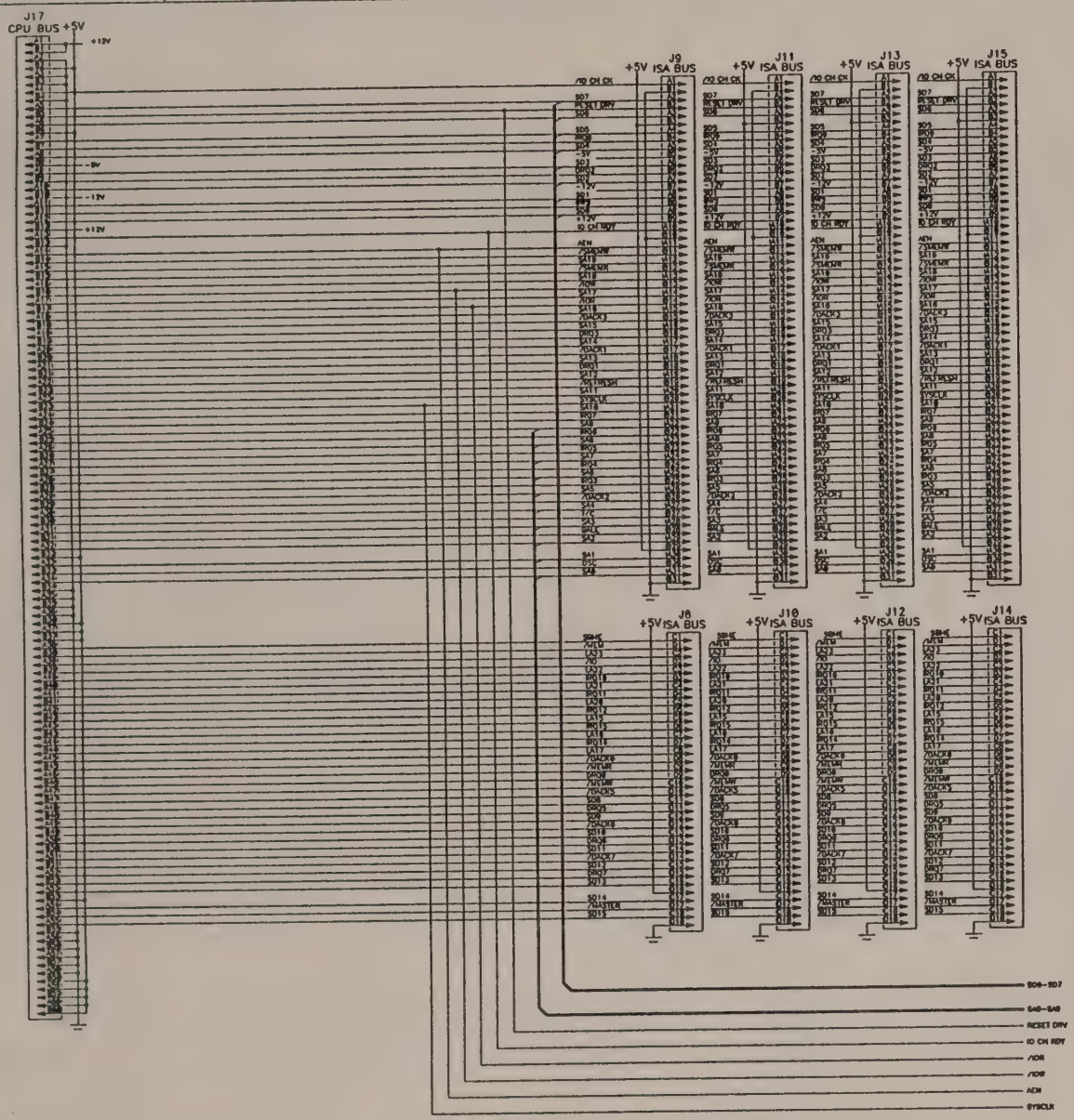
6.12 8440A-8443A CIRCUIT DIAGRAMS

The following pages contain circuit diagrams for the 8440A-8443A family of instrumentation computers and controllers.

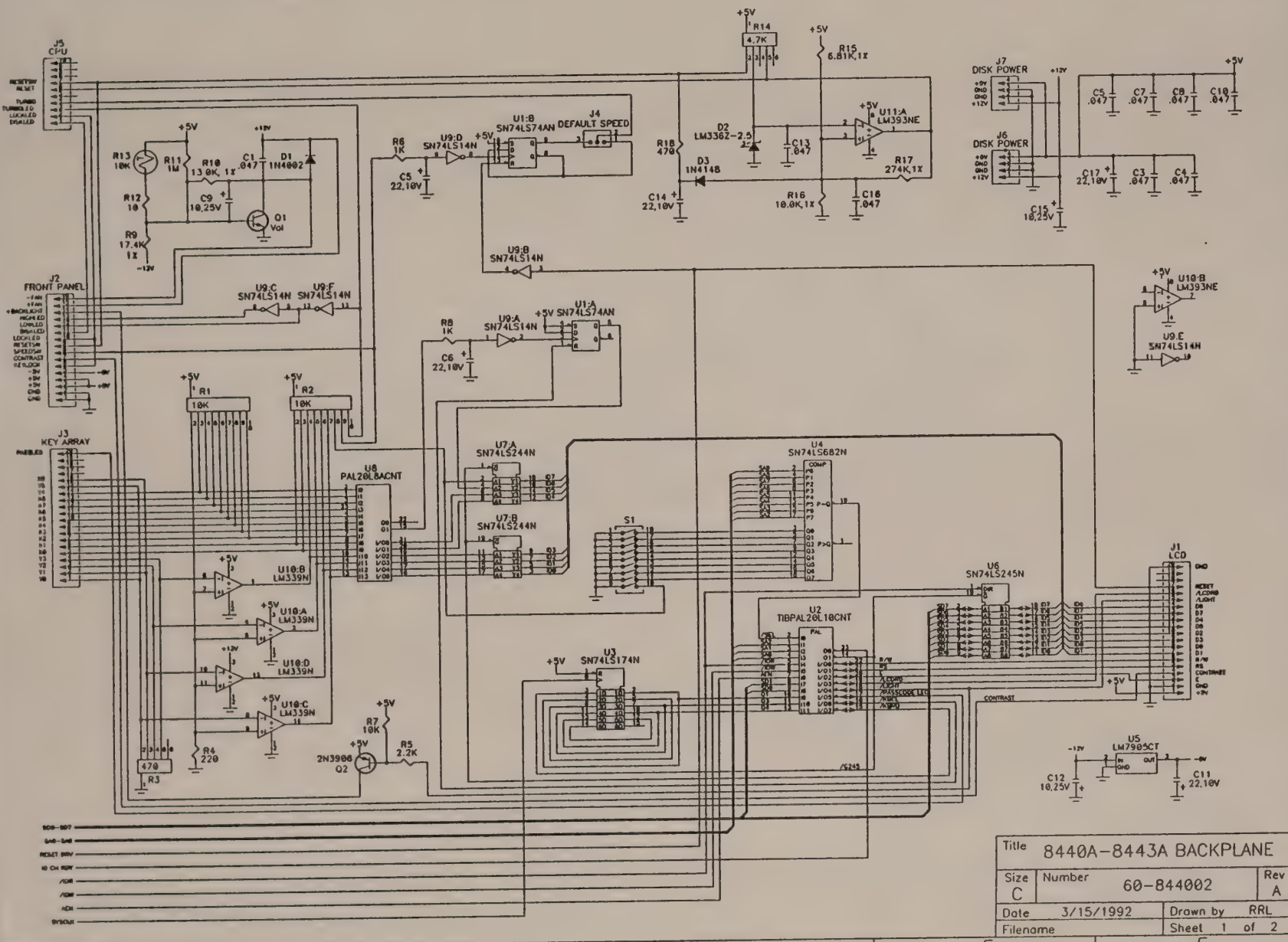


NOTE: THIS CIRCUIT BOARD CAN BE LOADED IN SEVERAL CONFIGURATIONS WHICH VARY WITH THE VERSION OF THE PRODUCT, SEE MATERIALS LIST

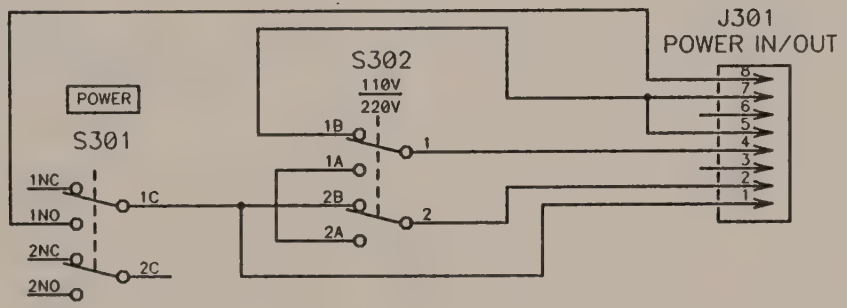
Title	8440A-8443A FRONT PANEL	
Size C	Number 60-844001	Rev A
Date 3/15/1992	Drawn by RRL	
Filename PCPCI1.S01	Sheet 1 of 1	



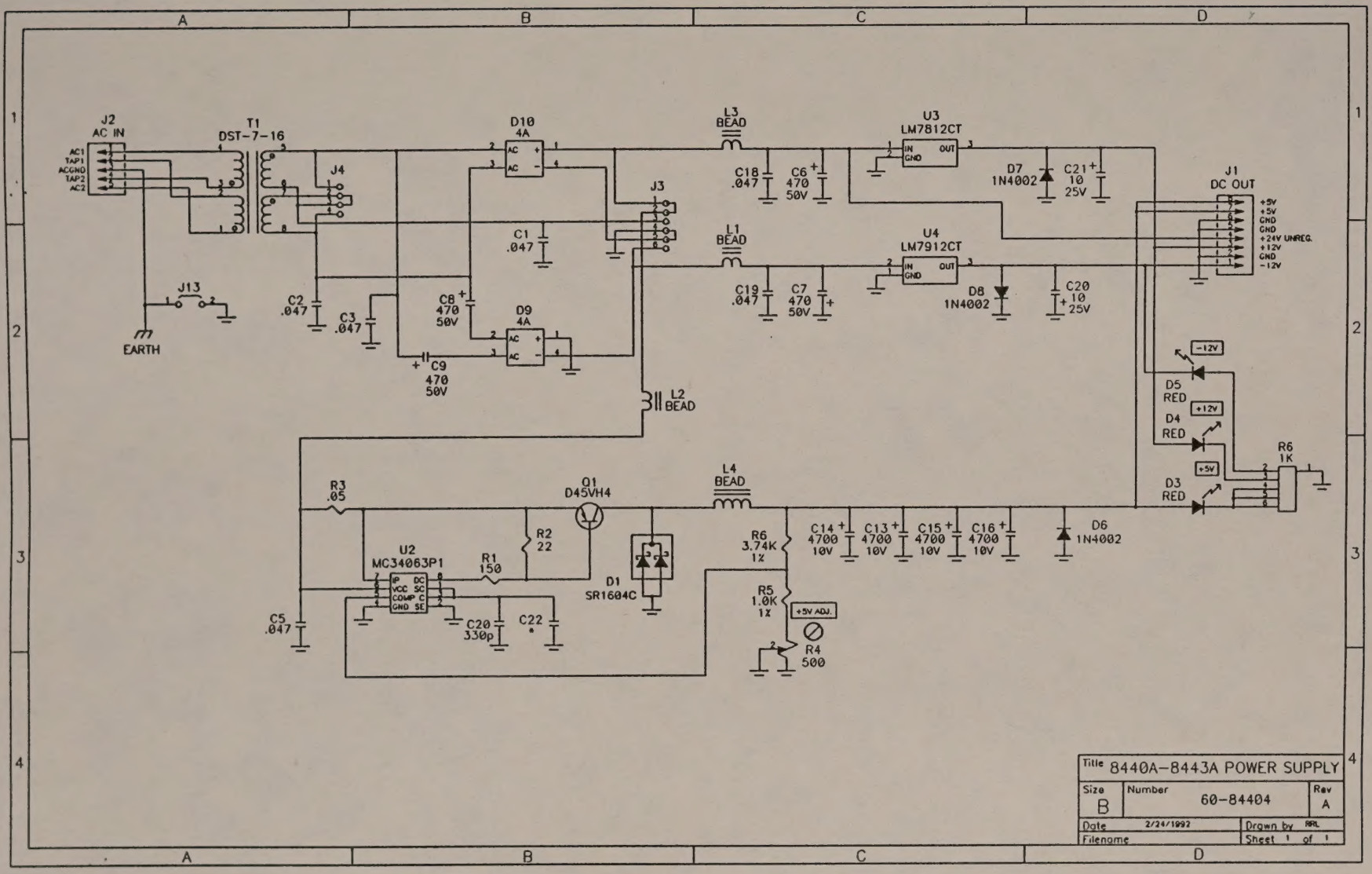
Title	8440A–8443A BACKPLANE		
Size C	Number 60–844002		Rev A
Date	3/15/1992	Drawn by	RRL
Filename		Sheet	2 of 2



Title	8440A–8443A BACKPLANE		
Size C	Number 60–844002		Rev A
Date 3/15/1992		Drawn by RRL	
Filename		Sheet 1 of 2	



Title	POWER SWITCH ASSY		
Size A	Number 60-844003		Rev A
Date 2/6/1992		Drawn by RRL	
Filename		Sheet 1 of 1	


J2
AC IN
AC1
TAP1
ACGND
TAP2
AC2
T1
DST-7-16
J4
J13
EARTH
C2
.047
C3
.047
C1
.047
C8
470
50V
C9
470
50V
D10
4A
D9
4A
J3
L2
BEAD
L3
BEAD
L1
BEAD
L4
BEAD
U3
LM7812CT
IN
GND
OUT
U4
LM7912CT
C18
.047
C6
470
50V
C19
.047
C7
470
50V
D7
1N4002
D8
1N4002
C21
10
25V
C20
10
25V
J1
DC OUT
+5V
+5V
GND
GND
+24V UNREG.
+12V
GND
-12V
-12V
D5
RED
+12V
D4
RED
+5V
D3
RED
R6
1K
R3
.05
Q1
D45VH4
U2
MC34063P1
IP DC
VCC SC
COMP C
GND SE
R1
150
R2
22
C5
.047
C20
330p
C22
D1
SR1604C
R6
3.74K
1%
R5
1.0K
1%
+5V ADJ.
R4
500
C14
4700
10V
C13
4700
10V
C15
4700
10V
C16
4700
10V
D6
1N4002
Title 8440A-8443A POWER SUPPLY
Size B
Number 60-84404
Rev A
Date 2/24/1992
Drawn by NRL
Filename
Sheet 1 of 1